

PROJECT MANUAL FOR:

CITY HALL REMODEL

CITY OF COLFAX
COLFAX, IOWA

BID DOCUMENTS

07 JULY 2020



WATERLOO

501 Sycamore Street, Suite 101
Waterloo, Iowa 50703
319.233.8419
319.233.9772 (fax)
invisionarch.com

DES MOINES

303 Watson Powell Jr. Way, Suite 200
Des Moines, Iowa 50309
515.633.2941
515.633.2942 (fax)
invisionarch.com

INVISION #: 19045

SET NUMBER: _____

SECTION 00 00 07
SEALS & SIGNATURES

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Architect under the laws of the State of Iowa. Name: Jason DeVries <table style="width: 100%;"><tr><td style="width: 50%;">Signature</td><td style="width: 50%;">Date</td></tr><tr><td>Registration Expires:</td><td>Iowa Reg No. 06713</td></tr><tr><td colspan="2">Pages or sheets covered by this seal: General & Architectural Series</td></tr><tr><td colspan="2">Divisions: Division 02 – 12, except those indicated below.</td></tr></table>	Signature	Date	Registration Expires:	Iowa Reg No. 06713	Pages or sheets covered by this seal: General & Architectural Series		Divisions: Division 02 – 12, except those indicated below.	
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Divisions: Division 02 – 12, except those indicated below.									
	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Engineer under the laws of the State of Iowa. Name: John Paul Goedken <table style="width: 100%;"><tr><td style="width: 50%;">Signature</td><td style="width: 50%;">Date</td></tr><tr><td>Registration Expires:</td><td>Iowa Reg No. 14831</td></tr><tr><td colspan="2">Pages or sheets covered by this seal: Structural Series</td></tr><tr><td colspan="2">Sections:</td></tr></table>	Signature	Date	Registration Expires:	Iowa Reg No. 14831	Pages or sheets covered by this seal: Structural Series		Sections:	
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	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Engineer under the laws of the State of Iowa. Name: Dave Inghram <table style="width: 100%;"><tr><td style="width: 50%;">Signature</td><td style="width: 50%;">Date</td></tr><tr><td>Registration Expires:</td><td>Iowa Reg No. 12567</td></tr><tr><td colspan="2">Pages or sheets covered by this seal: FP, M & P Series</td></tr><tr><td colspan="2">Divisions: 21, 22, & 23</td></tr></table>	Signature	Date	Registration Expires:	Iowa Reg No. 12567	Pages or sheets covered by this seal: FP, M & P Series		Divisions: 21, 22, & 23	
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Divisions: 21, 22, & 23									

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Engineer under the laws of the State of Iowa.	
	Name: _____	
	Signature _____	Date _____
	Registration Expires: _____	Iowa Reg No. 15842
	Pages or sheets covered by this seal: E, FA & T	
Divisions: 26, 27, & 28		

END OF SECTION

SECTION 00 01 10
TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

00 00 07 - Seals & Signatures Page	INV
00 01 10 - Table of Contents	INV
00 11 13 - Notice to Bidders	
00 21 13 - Instructions to Bidders	
00 41 00 - Bid Form	
00 50 00 - Contracting Forms and Supplements	
AIA A101-2017 Standard Form of Agreement between Owner and Contractor	
AIA A101-2017 Exhibit A Insurance and Bonds	
00 72 00 - General Conditions	
AIA A201-2017 General Conditions of the Contract	

SPECIFICATIONS

DIVISION 01 -- GENERAL REQUIREMENTS

01 10 00 - Summary of Work	INV
01 20 00 - Price and Payment Procedures	INV
01 21 00 - Allowances	INV
01 22 00 - Unit Prices	INV
01 23 00 - Alternates	INV
01 30 00 - Administrative Requirements	INV
01 40 00 - Quality Requirements	INV
01 43 39 - Mockup Requirements	INV
01 45 33 - Code Required Testing and Inspections	INV
01 50 00 - Temporary Facilities and Controls	INV
01 60 00 - Product Requirements	INV
01 60 10 - Substitution Procedures	INV
01 60 10.01 - Substitution Request Form	INV
01 70 00 - Execution and Closeout Procedures	INV
01 78 00 - Closeout Submittals	INV

DIVISION 02 -- EXISTING CONDITIONS

02 41 00 - Demolition	INV

DIVISION 03 -- CONCRETE

03 30 00 - Cast-in-Place Concrete	INV
03 35 11 - Concrete Floor Finishes	INV

DIVISION 04 -- MASONRY

04 20 00 - Unit Masonry	INV
04 72 00 - Cast Stone Masonry	INV

DIVISION 05 -- METALS

05 50 00 - Metal Fabrications	INV

DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

06 10 00 - Rough Carpentry	INV
06 20 00 - Finish Carpentry	INV
06 41 00 - Architectural Wood Casework	INV

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

07 01 50.19 - Roofing Repair and Replacement	INV
07 21 00 - Thermal Insulation	INV
07 62 00 - Sheet Metal Flashing and Trim	INV
07 84 00 - Firestopping	INV
07 92 00 - Joint Sealants	INV

DIVISION 08 -- OPENINGS

08 11 13 - Hollow Metal Doors and Frames	INV
08 14 16 - Flush Wood Doors	INV
08 31 00 - Access Doors and Panels	INV
08 43 13 - Aluminum-Framed Storefronts	INV
08 71 00 - Door Hardware	AHC
08 80 00 - Glazing	INV

DIVISION 09 -- FINISHES

09 05 61 - Common Work Results for Flooring Preparation	INV
09 21 16 - Gypsum Board Assemblies	INV
09 30 00 - Tiling	INV
09 51 00 - Acoustical Ceilings	INV
09 65 00 - Resilient Flooring	INV
09 65 66 - Resilient Athletic Flooring	INV
09 68 13 - Tile Carpeting	INV
09 91 13 - Exterior Painting	INV
09 91 23 - Interior Painting	INV
09 93 00 - Staining and Transparent Finishing	INV
09 96 00 - High Performance Coating	INV

DIVISION 10 -- SPECIALTIES

10 11 00 - Visual Display Units	INV
10 14 00 - Signage	INV
10 14 05 - Applied Graphics	INV
10 26 00 - Wall and Door Protection	INV
10 28 00 - Toilet, Bath, and Laundry Accessories	INV
10 44 00 - Fire Protection & Safety Specialties	INV
10 51 13 - Metal Lockers	INV
10 75 00 - Flagpoles	INV

DIVISION 11 -- EQUIPMENT (NOT USED)**DIVISION 12 -- FURNISHINGS**

12 24 00 - Window Shades	INV
12 36 00 - Countertops	INV

DIVISION 13 - SPECIAL CONSTRUCTION (NOT USED)**DIVISION 14 - CONVEYING EQUIPMENT (NOT USED)****DIVISION 21 - FIRE SUPPRESSION****IMEG**

21 05 00 - Basic Fire Suppression Requirements
21 05 03 - Through Penetration Firestopping
21 05 29 - Fire Suppression Supports and Anchors
21 13 00 - Fire Protection Systems

DIVISION 22 - PLUMBING**IMEG**

22 05 00 - Basic Plumbing Requirements
22 05 03 - Through Penetration Firestopping
22 05 13 - Motors
22 05 53 - Plumbing Identification
22 07 19 - Plumbing Piping Insulation
22 10 00 - Plumbing Piping
22 10 23 - Natural Gas and Propane Piping
22 10 30 - Plumbing Specialties
22 30 00 - Plumbing Equipment
22 40 00 - Plumbing Fixtures

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

23 05 00 - Basic HVAC Requirements
23 05 03 - Through Penetration Firestopping
23 05 13 - Motors

23 05 93 - Testing, Adjusting and Balancing
23 07 13 - Ductwork Insulation
23 31 00 - Ductwork
23 33 00 - Ductwork Accessories
23 34 23 - Power Ventilators
23 37 00 - Air Inlets and Outlets
23 54 00 - Force Air Furnaces
23 81 26 - Split System Air Conditioning Units
23 82 00 - Terminal Heat Transfer Units

DIVISION 24 -- RESERVED (NOT USED)

DIVISION 25 -- INTEGRATED AUTOMATION (NOT USED)

DIVISION 26 - ELECTRICAL

IMEG

26 05 00 - Basic Electrical Requirements
26 05 13 - Wire and Cable
26 05 17 - Electric Heat Trace and Snow Melt
26 05 26 - Grounding and Bonding
26 05 27 - Supporting Devices
26 05 33 - Conduit and Boxes
26 05 53 - Electrical Identification
26 09 16 - Electrical Controls and Relays
26 09 33 - Lighting Control Systems
26 20 00 - Service Entrance
26 24 16 - Panelboards
26 27 26 - Wiring Devices
26 28 16 - Disconnect Switches
26 28 21 - Contactors
26 32 13 - Packaged Engine Generator Systems
26 36 00 - Transfer Switch
26 43 00 - Surge Protection Devices
26 51 19 - LED Lighting

DIVISION 27 - COMMUNICATIONS

IMEG

27 05 00 - Basic Communications Systems Requirements
27 05 26 - Communications Bonding
27 05 28 - Interior Communication Pathways
27 05 53 - Identification and Administration
27 11 00 - Communication Equipment Rooms
27 15 00 - Horizontal Cabling Requirements
27 17 10 - Testing

27 17 20 - Support and Warranty

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

IMEG

28 05 00 - Basic Safety and Security Systems Requirements

28 13 00 - Electronic Access Control

28 23 00 - Video Surveillance

28 31 00 - Fire Alarm and Detection Systems

DIVISION 29 -- RESERVED (NOT USED)

DIVISION 30 -- RESERVED (NOT USED)

DIVISION 31 -- EARTHWORK (NOT USED)

DIVISION 32 -- EXTERIOR IMPROVEMENTS (NOT USED)

DIVISION 33 -- UTILITIES (NOT USED)

END OF SECTION

SECTION 00 11 13
NOTICE TO BIDDERS

NOTICE IS HEREBY GIVEN: That sealed bids will be received by the City of Colfax, Iowa at Colfax City Hall, 19 E Howard St, Colfax, IA 50054 until 2:00 PM CDT on the 10th of August, 2020. The bids will be opened at 7:00 PM in the Fire Station and publicly read aloud. The project consists of furnishing the following supplies, equipment, and/or services.

COLFAX CITY HALL REMODEL

COLFAX, IOWA

INVISION PROJECT NO. 19045

The bids are for a single Prime Contract (civil, general, mechanical and electrical combined) for a one-story 7500 square foot renovation. The renovation consists of concrete slabs on grade repair, built up metal framed floors, wood truss repairs, minor roofing investigation and repair, masonry repair, fire suppression systems and alarms, new mechanical system using new condenser units, plumbing system and fixtures, new electrical system and lighting fixtures, and technology components. The renovation of the existing space consists of minor interior demolition, new interior stud walls, new doors and frames, new casework, interior finishes. Site work consists of minor demolition of existing site components, new pavers, utilities replacement, stormwater management, minor grading and seeding.

The estimated construction cost for the Project is \$ 1.3 million.

A Public Hearing will be conducted at a meeting to be held at the Colfax Fire Station, 113 W State St, Colfax, IA 50054 at 7:00 p.m., on the 10th day of August, 2020, at which time and place any person may appear and file objections to the proposed plans, specifications, form of contract, and the estimated cost of said project.

A pre-bid conference is scheduled for July 22, 2020 at 9:00 a.m. at the Colfax Fire Station, 113 W State St, Colfax, IA 50054; with a walk-through of the existing building immediately following.

The City Council will review bids, recommendations and award contract at the Colfax Fire Station, 113 W State St, Colfax, IA 50054, 2020 Regular Board meeting at 7:00 p.m., on the 10th day of August, 2020.

Work is anticipated to commence upon award of contract or Notice to Proceed, on or about August 17, 2020, and be substantially complete by February 26, 2021 and work completed by March 31, 2021, constructed in one phase as shown on the Contract Documents.

Plans and specifications governing the construction of the proposed Work have been prepared by INVISION Architects of Des Moines, Iowa.

Direct questions to Mike Dean, miked@invisionarch.com; 515-657-4722, or the design professionals identified within the Project Directory (drawing cover sheet)

Copies of the Bidding Documents may be obtained through Iowa Reprographics via their website at www.iowarepro.com, by email at "plans@iowarepro.com", by phone at 515-244-5705; or in person at 3 College Ave Unit 3, Des Moines, IA 50314, in accordance with the Instructions to Bidders.

Bidders may obtain sets of the Bidding Documents in accordance with the Instructions to Bidders upon depositing the sum of \$150.00 (written to City of Colfax) or a MBI Plan Deposit card for each set of documents.

A second, non-refundable check for \$15.00 made out to the printer shall be included if shipping is desired.

Deposit will be refunded if Bid Documents are returned complete, undamaged, unmarked and reusable, within 7 days of bid submission. Failure to comply will result in forfeiture of deposit.

Circulating sets are available at Colfax City Hall, for the same deposit sum, for all other sub-bidders for a maximum check-out period of four days. Circulating set deposit will be cashed and will become the property of the depositor if not returned within the four day check-out period.

All bidders may register for free access to this Project at www.iowarepro.com/plan-distribution. Once logged onto the project through the public planroom, bidding documents may be downloaded, viewed and printed. Phone: 515-244-5705 or email: plans@iowarepro.com

Documents may also be viewed at the following plan rooms:

1. Beeline + Blue; Attn: McGraw Hill Plan Room; 2507 Ingersoll Avenue; Des Moines, IA 50312; 515-244-1611; <https://www.beelineandblue.com>.
2. Bid+Builders Exchange, 4814 E. Broadway, Madison, WI, 608-221-3148
3. Construction Market Data (CMD, formerly Reed Construction Data); 30 Technology Parkway Norcross, GA 30092; (800) 424-3996; www.cmdgroup.com.
4. Construction Update Online Plan Room; Master Builders of Iowa, 221 Park St. Des Moines, IA, 50303, 515-288-8904; <http://www.mbionline.com>
5. Dodge Data and Analytics (online plan room); 4300 Beltway Place, Suite 180; Arlington, TX 73018; ph. (877) 784-9556. <http://dodgeprojects.construction.com>.
6. Eplan; 3806 Buttonwood Drive, Suite 106, Columbia MO 65201; www.eplanbidding.com
7. iSqFt (online plan room); ph. (800)364-2059; www.isqft.com.
8. North Iowa Builders Exchange Plan Room; 9 North Federal Ave; Mason City, IA 50401
9. Rapids Reproduction/Technigraphics, 6201 Chancellor Drive, Cedar Falls, IA 50613; 319 277 5538.
10. Rapids Reproduction; 872 Elmore Avenue, Davenport, IA. 52807; ph (800) 383-1223.
11. Rapids Reproduction/Technigraphics, 415 Highland Ave, Suite 100, Iowa City, IA; 52240 ph: 319-354-5950 /800-779-0093.

Bid security in the amount of 10% of the total bid in the form of certified check, credit union share draft, or surety bond written on an original AIA Document A310, Bid Bond is required for this project, and must be submitted at the time of bid. The successful bidder will be required to provide surety Performance and Payment Bonds in an amount equal to one hundred percent (100%) of the Contract Sum.

Refer to other bidding requirements described in Instructions to Bidders.

Submit your offer on the Bid Form provided.

Your offer will be required to be submitted under a condition of irrevocability for a period of thirty (30) days after submission.

The award of the contract may be made by the City of Colfax to any responsible bidder or bidders offering suitable supplies, equipment and/or service at the lowest price taking into consideration the quality of materials or service in the best interest of the Owner. The right is reserved to reject any and all bids, or any part thereof, and to waive informalities, and to enter into such contract or contracts as shall be deemed in the best interest of the Owner.

By virtue of statutory authority, preference will be given to products and provisions grown and coal produced within the State of Iowa.

By order of the City Council, Colfax, Iowa.

Publish July 2020

Des Moines Register,
Newton Daily News,
Altoona Herald,
Iowa League of Cities (website)

END OF SECTION

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 DOCUMENT INCLUDES

- A. Invitation to Bid, and other relevant information and requirements.

1.02 RELATED DOCUMENTS

- A. Document 01 10 00 - Summary.
- B. Document 00 41 00 - Bid Form.

INVITATION

2.01 BID SUBMISSION

- A. Bids for the project, signed and under seal, executed, and dated will be received at the office of Colfax City Hall at 19 E Howard St, Colfax, IA 50054 before 2:00 p.m. local daylight time on the 10th day of August, 2020.
- B. Offers submitted after the above time may be returned to the bidder unopened.
- C. Submit required Supplements To Bid Forms within 24 hours after closing time for receiving bids.
- D. Offers will be opened at 7:00 p.m. on the 10th day of August, 2020, at the Colfax Fire Station, 113 W State St, Colfax, IA 50054.
- E. Successful bidders will be notified of award by August 17, 2020.

2.02 INTENT

- A. The intent of this Bid request is to obtain an offer to perform work to complete a interior renovation of an existing building located at 20 W Howard Street, Colfax, Iowa 50054 for a Stipulated Sum contract, in accordance with the Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises renovation, including general construction, structural, mechanical, electrical, and plumbing Work.

2.04 CONTRACT TIME

- A. Pre-construction Work may begin with issuance of Notice to Proceed.
- B. Perform the Work within the time stated in Section 00 41 00 - Bid Form.
- C. The bidder, in submitting an offer, accepts the Contract Time period stated for performing the Work. The completion date in the Agreement shall be the Contract Time added to the commencement date.

BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

- A. Bid Documents: Contract Documents supplemented with Instructions to Bidders, Bid Form Supplements To Bid Forms and Appendices identified.
- B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.
- C. Bid, Offer, or Bidding: Act of submitting an offer under seal.
- D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

3.02 CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents are identified as Project Number 19045, as prepared by INVISION Architects, and with contents as identified in the Table of Contents of the Project Manual and Index of Sheets on the Drawings.

3.03 BIDDER'S REPRESENTATIONS

- A. The Bidder by making a Bid represents that:
 - 1. The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.
 - 2. The Bid is made in compliance with Bidding Documents.
 - 3. The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.
 - 4. The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

3.04 AVAILABILITY

- A. Documents may be obtained only by Invited Bidders.
 - 1. Contact Mike Dean regarding invitation questions; miked@invisionarch.com or phone: 515-657-4722.
- B. Bid documents may be obtained at Rapids Reproductions.
 - 1. Full sets of Bid Documents can be obtained by upon receipt of a refundable deposit, by certified check, or current MBI card, in the amount of \$150.00 for one set.
 - 2. Qualified plan houses receive all-branch sets free of charge, provided they log all usage of the documents and return to the printer within fourteen (14) days after bidding.
 - 3. A non-refundable check for \$15.00 made out to the printer shall be included if shipping is desired.
 - 4. Deposit will be refunded if Bid Documents are returned complete, undamaged, unmarked and reusable, within 7 days of bid submission. Failure to comply will result in forfeiture of deposit.
- C. Contractors, subcontractors and suppliers may view plans and specifications on www.iowarepro.com/plan-distribution/plan-distribution.
- D. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.
- E. Bidder shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- F. Addenda will be available online at Iowa Reprographics and online planrooms.

3.05 EXAMINATION

- A. Bid Documents may be viewed at the office of Architect which is located at 303 Watson Powell Jr. Way, Suite 200; Des Moines, IA 50309.
- B. Bid Documents are on display at the offices of the following construction plan rooms:
 - 1. Beeline + Blue; Attn: McGraw Hill Plan Room; 2507 Ingersoll Avenue; Des Moines, IA 50312; 515-244-1611; <https://www.beelineandblue.com>.
 - 2. Bid+Builders Exchange, 4814 E. Broadway, Madison, WI, 608-221-3148
 - 3. Construction Market Data (CMD, formerly Reed Construction Data); 30 Technology Parkway Norcross, GA 30092; (800) 424-3996; www.cmdgroup.com.
 - 4. Construction Update Online Plan Room; Master Builders of Iowa, 221 Park St. Des Moines, IA, 50303, 515-288-8904; <http://www.mbsonline.com>
 - 5. Dodge Data and Analytics (online plan room); 4300 Beltway Place, Suite 180; Arlington, TX 73018; ph. (877) 784-9556. <http://dodgeprojects.construction.com>.
 - 6. Eplan; 3806 Buttonwood Drive, Suite 106, Columbia MO 65201; www.eplanbidding.com
 - 7. iSqFt (online plan room); ph. (800)364-2059; www.isqft.com.

8. North Iowa Builders Exchange, 9 North Federal Avenue, Mason City, IA 50401, 641-423-5334.
 9. Rapids Reproduction/Technigraphics, 6201 Chancellor Drive, Cedar Falls, IA 50613; 319 277 5538.
 10. Rapids Reproduction; 872 Elmore Avenue, Davenport, IA. 52807; ph (800) 383-1223.
 11. Rapids Reproduction/Technigraphics, 415 Highland Ave, Suite 100, Iowa City, IA; 52240 ph: 319-354-5950 /800-779-0093.
- C. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.
 - D. Immediately notify Architect upon finding discrepancies or omissions in the Bid Documents.

3.06 INQUIRIES/ADDENDA

- A. Direct questions to Mike Dean, via email or phone; miked@invisionarch.com;515-657-4722.
- B. Addenda may be issued during the bidding period. All Addenda become part of Contract Documents. Include resultant costs in the Bid Amount.
- C. Verbal answers are not binding on any party.
- D. The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect error, inconsistencies or ambiguities discovered.
- E. Clarifications requested by bidders must be in writing not less than five (5) days before date set for receipt of bids. The reply will be in the form of an Addendum, a copy of which will be forwarded to known recipients and plan holders.
- F. Each bidder shall indicate receipt of addendum on bid form.

3.07 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

- A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to five (5) days before receipt of bids.
- B. When a request to substitute a product is made, Architect may approve the substitution and will issue an Addendum to known bidders.
- C. The submission shall provide sufficient information to determine acceptability of such products.
- D. Provide complete information on required revisions to other work to accommodate each proposed substitution.
- E. In submission of substitutions to products specified, bidders shall include in their bid all changes required in the Work and changes to Contract Time and Contract Sum to accommodate such substitutions. A later claim by the bidder for an addition to the Contract Time or Contract Sum because of changes in work necessitated by use of substitutions shall not be considered.
- F. Provide products as specified unless substitutions are submitted in this manner and accepted.
- G. See Section 01 60 00 - Product Requirements for additional requirements.

SITE ASSESSMENT

4.01 SITE EXAMINATION

- A. Examine the project site before submitting a bid.
 1. Extra costs for Work not identified on the drawings, but clearly visible, will not be considered.
- B. A visit to the project site has been arranged for bidders as follows: immediately after the pre-bid conference.
- C. The exterior can be toured at any time, the interior will only be available for tour at the prebid.

4.02 PREBID CONFERENCE

- A. A mandatory bidders conference has been scheduled for 9:00 a.m. on the 22nd day of July, 2020 (Wednesday) at the location of the Colfax Fire Station, 113 W State St, Colfax, IA 50054.
- B. All general contract and subcontract bidders and suppliers are invited.
- C. Representatives of Architect and Engineers will be in attendance.
- D. Summarized minutes of this meeting will be circulated to attendees. These minutes will not form part of the Contract Documents.
- E. Information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.

QUALIFICATIONS

5.01 EVIDENCE OF QUALIFICATIONS

- A. To demonstrate qualification for performing the Work of this Contract, bidders may be requested to submit written evidence of financial position, license to perform work in the State.

5.02 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Owner reserves the right to reject a proposed subcontractor for reasonable cause.
- B. Refer to General Conditions.

BID SUBMISSION

6.01 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.
- B. Submit one copy of the executed offer on the Bid Forms provided, signed with the required security and bonding and insurance requirements, in a closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.
 - 1. Label shall include:
 - a. **BID PROPOSAL FOR Colfax City Hall Remodel**
 - b. <the contractor's name>
 - c. Attn: City Clerk, 19 E. Howard Street, Colfax, IA 50054 (phone: 515-674-4096)
 - d. <Bid Letting Date>
 - 2. If envelopes are not clearly marked, the bid might be mistakenly opened outside the official bid letting rendering it invalid.
- C. Oral, telephonic, facsimile or other electronically transmitted bids will not be considered.
- D. Hand deliver to the location specified by the date and time as noted above.

6.02 BID INELIGIBILITY

- A. Bids that are unsigned or improperly signed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Owner, be declared unacceptable.
- C. Bids are by invitation, only from selected bidders. Bids from unsolicited bidders may be returned.

BID ENCLOSURES/REQUIREMENTS

7.01 SECURITY DEPOSIT

- A. Bids shall be accompanied by a security deposit as follows:
 - 1. Bid Bond of a sum no less than 10 percent of the Bid Amount on AIA A310 Bid Bond Form, or standard surety company form, or a certified bank check made payable to the Owner.

- B. Endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.
- C. The security deposit will be returned after delivery to the Owner of the required Performance and Payment Bond(s) by the accepted bidder.
- D. Include the cost of bid security in the Bid Amount.
- E. After a bid has been accepted, all securities will be returned to the respective bidders and other requested enclosures.
- F. If no contract is awarded, all security deposits will be returned.

7.02 PERFORMANCE ASSURANCE

- A. Accepted Bidder is to provide the following:
 - 1. Provide a 100 percent Performance Bond on AIA A312, or standard surety form.
 - 2. Provide a 100 percent Payment Bond on AIA A311, or standard surety form.
- B. Include the cost of Performance and Payment Bonds in the Bid Amount and identify the cost when requested.

7.03 INSURANCE

- A. Provide executed "Certificate of Insurance" on a standard form provided by the insurance company stating their intention to provide insurance to the bidder in accordance with the insurance requirements of the Contract Documents within ten (10) days after the acceptance of bid.
 - 1. Upon request by the Owner, provide Certificated of Insurance for all subcontractors and sub-sub contractors who perform work or services pursuant to the provisions of this contract.

7.04 BID FORM REQUIREMENTS

- A. Complete all requested information in the Bid Form and Appendices.

7.05 SALES AND USE TAXES

- A. This is a sales tax-free construction project. Bidders shall NOT include state sales taxes in their proposals. The Owner will issue a state sales tax exemption certificate for all materials purchased for the project and will issue the appropriate tax exemption certificates and authorization letters to the Contractors and all subcontractors performing work on the project. Tax exemption certificates are applicable only for the specific project for which the certificates are issued. The Contractors shall provide a listing to the Owner of all appropriate subcontractors which are qualified to use the tax exemption certificate. The Contractors and subcontractors may make copies of the tax exemption certificate and may provide a copy to each supplier providing construction material. Materials for this contract may then be purchased free from sales tax. Suppliers shall retain this certificate for at least three years.

7.06 ADDITIONAL BID INFORMATION

- A. Submit the following Supplements 24 hours after bid submission:
 - 1. Document 00 43 36 - Proposed Subcontractors Form: Include the names of all Subcontractors and the portions of the Work they will perform.
- B. The Contractor shall file for the building permit.
 - 1. Permit fees will be waived by the City.

7.07 SELECTION AND AWARD OF ALTERNATES

- A. Indicate variation of bid price for Alternates listed on the Bid Form. Unless otherwise indicated, indicate Alternates as a difference in bid price by adding to or deducting from the base bid price.
- B. Alternate pricing may inform the selection of the successful bidder.

OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.

8.02 ACCEPTANCE OF OFFER

- A. Owner reserves the right to accept or reject any or all offers and to waive any irregularities or informalities.
- B. After acceptance, a written Notice to Proceed will be sent to the successful bidder by the Owner or the Architect on behalf of the Owner.

END OF SECTION

SECTION 00 41 00

BID FORM

THE PROJECT AND THE PARTIES

1.01 TO:

A. City of Colfax (Owner)

1.02 RECEIVED BY:

A. City Clerk
City of Colfax
19 E. Howard Street
Colfax, IA 50054
Phone: 55-674-4096

1.03 FOR:

A. Project: Colfax City Hall Remodel
20 W Howard Street
Colfax, IA 50054
B. INVISION Architecture Project Number: 19045

1.04 DATE: _____ (BIDDER TO ENTER DATE)

1.05 SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)

A. Bidder's Full Name _____
1. Address _____
2. City, State, Zip: _____
3. Phone: _____

1.06 OFFER

- A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by INVISION Architecture for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:
- B. _____ dollars
(\$ _____), in lawful money of the United States of America.
- C. We have included the required security deposit as required by the Instruction to Bidders.
- D. We have included the required performance assurance bonds in the Bid Amount as required by the Instructions to Bidders.
1. The cost of the required performance assurance bonds is _____ dollars
(\$ _____), in lawful money of the United States of America.
- E. All applicable federal taxes are included and State of Iowa taxes are included in the Bid Sum.
- F. All Cash and Contingency Allowances described in Section 01 21 00 - Allowances are included in the Bid Sum.

1.07 ACCEPTANCE

- A. This offer shall be open to acceptance and is irrevocable for thirty days from the bid closing date.
- B. If this bid is accepted by Owner within the time period stated above, we will:
1. Execute the Agreement within seven (7) days of receipt of Notice of Award.
 2. Furnish the required bonds within seven (7) days of receipt of Notice of Award.
 3. Commence work as agreed upon with the Owner after written Notice to Proceed of this bid, estimated to be on or near August 17, 2020.

- C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.
- D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.08 CONTRACT TIME

- A. If this Bid is accepted, we will:
- B. Commence work as agreed upon with the Owner after written Notice to Proceed of this bid.
- C. Commence work on or around August 17, 2020.
- D. Substantially complete the Work by the 26th day of February 2021.
 - 1. Certificate of Occupancy shall be obtained in time for occupancy to also occur on the above date.
- E. Complete the Work on or before March 31, 2021.

1.09 ALLOWANCES - SEE SECTION 01 21 00

- A. Owner's Contingency allowances are to be included in the bid. See Section 01 21 00 - Allowances for amounts and procedure for its use.

1.10 UNIT PRICES - SEE SECTION 01 22 00

- A. The Owner has requested Unit Pricing for specific portions of the Work as listed. Unit prices shall be total cost to Owner, per unit of Work, including indirect costs and overhead and profit.
- B. Bidder, in submitting his bid proposal, shall include Unit Pricing for the following items:

ITEM DESCRIPTION	UNIT PRICE	UNIT OF MEASURE
1. Masonry Cleaning	\$ _____	per square foot (SF)
2. Brick Repair	\$ _____	per brick
3. Tuckpointing	\$ _____	per linear foot (LF)
4. Roof Repair	\$ _____	per square foot (SF)

1.11 ALTERNATES - SEE SECTION 01 23 00

- A. Alternates are identified by number and describe the basic changes to be incorporated into the Work only when that Alternate is made a part of the Work by specific provisions in the Owner-Contractor Agreement. Bidder, in submitting his bid proposal, shall include, in addition to his base bid, the following alternates. The numerical order of listing these alternates does not necessarily imply their priority. The Owner may decide to use any one or more of all the items. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate and to provide the complete construction required by the Contract Documents.
- B. Alternates identified on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
- C. Bidder, in submitting his bid proposal, shall include, in addition to his base bid, the following alternates:
 - 1. **ALTERNATE NO. 1:** Snow Melt System
ADD or DEDUCT the Sum of : _____ DOLLARS (\$ _____)
 - 2. **ALTERNATE NO. 2:** Storage 118 Construction
ADD or DEDUCT the Sum of : _____ DOLLARS (\$ _____)

3. **ALTERNATE NO. 3:** Countertops
ADD or DEDUCT the Sum of : _____ DOLLARS (\$ _____)
4. **ALTERNATE NO. 4:** Generator
ADD or DEDUCT the Sum of : _____ DOLLARS (\$ _____)

1.12 CHANGES TO THE WORK

- A. When Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:
1. _____ percent overhead and profit on the net cost of our own Work;
 2. _____ percent on the cost of work done by any Subcontractor.
- B. On work deleted from the Contract, our credit to Owner shall be Architect-approved net cost plus _____ of the overhead and profit percentage noted above.

1.13 ADDENDA

- A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
1. Addendum # ____ Dated _____
 2. Addendum # ____ Dated _____
 3. Addendum # ____ Dated _____

1.14 BID FORM SUPPLEMENTS

- A. We agree to submit the following Supplements to Bid Forms within 24 hours after submission of this bid for additional bid information:
1. Document 00 43 36 - Proposed Subcontractors Form: Include the names of all Subcontractors and the portions of the Work they will perform.

1.15 BID FORM SIGNATURE(S)

- A. _____
(Bidder - print the full name of your firm)
- B. _____
(Authorized signing officer, Title)

END OF SECTION

SECTION 00 50 00
CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. See Section 00 72 00 - General Conditions for the General Conditions.
- B. The Agreement is based on AIA A101.
 - 1. See AIA A101 Exhibit A immediately following this section for Insurance and Bond requirements.
- C. The General Conditions are based on AIA A201.

1.02 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.
- B. Bond Forms:
 - 1. Bid Bond Form: AIA A310.
 - 2. Performance and Payment Bond Form: AIA A312.
- C. Post-Award Certificates and Other Forms:
 - 1. Schedule of Values Form: AIA G703.
 - 2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).
- D. Clarification and Modification Forms:
 - 1. Substitution Request Form (During Construction): see Section 01 60 10.01.
 - 2. Architect's Supplemental Instructions Form: AIA G710.
 - 3. Construction Change Directive Form: AIA G714.
 - 4. Change Order Form: AIA G701.
- E. Closeout Forms:
 - 1. Certificate of Substantial Completion Form: AIA G704.

1.03 REFERENCE STANDARDS

- A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum.
- B. AIA A201 - General Conditions of the Contract for Construction.
- C. AIA A310 - Bid Bond.
- D. AIA A312 - Performance Bond and Payment Bond.
- E. AIA G701 - Change Order.
- F. AIA G702 - Application and Certificate for Payment.
- G. AIA G703 - Continuation Sheet.
- H. AIA G704 - Certificate of Substantial Completion.
- I. AIA G710 - Architect's Supplemental Instructions.
- J. AIA G714 - Construction Change Directive.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 52 00
AGREEMENT FORM

PART 1 GENERAL

1.01 FORM OF AGREEMENT

1.02 THE AGREEMENT TO BE EXECUTED IS ATTACHED FOLLOWING THIS PAGE.

1.03 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DRAFT AIA® Document A101™ – 2017

Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

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

« »
« »

THE OWNER:
(Name, legal status and address)

« »« »
« »

THE CONTRACTOR:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

- A.1 GENERAL
- A.2 OWNER'S INSURANCE
- A.3 CONTRACTOR'S INSURANCE AND BONDS
- A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

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

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.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

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§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 **Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss

Sub-Limit

§ A.2.3.1.2 **Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage

Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 **Deductibles and Self-Insured Retentions.** If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 **Occupancy or Use Prior to Substantial Completion.** The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

- [☐] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

☐ ☐

- [☐] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

☐ ☐

- [☐] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

☐ ☐

- [☐] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

☐ ☐

- [☐] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

☐ ☐

- [☐] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

☐ ☐

- [☐] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

☐ ☐

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

- [« »] § A.2.5.1 **Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

« »

- [« »] § A.2.5.2 **Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 **Certificates of Insurance.** The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 **Deductibles and Self-Insured Retentions.** The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 **Additional Insured Obligations.** To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than « » (\$ « ») each occurrence, « » (\$ « ») general aggregate, and « » (\$ « ») aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and

.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than « » (\$ « ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than « » (\$ « ») each accident, « » (\$ « ») each employee, and « » (\$ « ») policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

- [« »] § A.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

- [« »] § A.3.3.2.2 Railroad Protective Liability Insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate, for Work within fifty (50) feet of railroad property.
- [« »] § A.3.3.2.3 Asbestos Abatement Liability Insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.
- [« »] § A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.
- [« »] § A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.
- [« »] § A.3.3.2.6 Other Insurance
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage**Limits****§ A.3.4 Performance Bond and Payment Bond**

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type

Penal Sum (\$0.00)

Payment Bond

Performance Bond

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

<< >>



**SECTION 00 72 00
GENERAL CONDITIONS**

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT IS ATTACHED FOLLOWING THIS PAGE.

END OF SECTION

DRAFT AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

<>>

THE OWNER:

(Name, legal status and address)

THE ARCHITECT:

(Name, legal status and address)

< >< >

< >

TABLE OF ARTICLES

1	GENERAL PROVISIONS
2	OWNER
3	CONTRACTOR
4	ARCHITECT
5	SUBCONTRACTORS
6	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7	CHANGES IN THE WORK
8	TIME
9	PAYMENTS AND COMPLETION
10	PROTECTION OF PERSONS AND PROPERTY
11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
13	MISCELLANEOUS PROVISIONS
14	TERMINATION OR SUSPENSION OF THE CONTRACT
15	CLAIMS AND DISPUTES

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INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,
10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,
3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and

Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2,
4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4,
9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7,
9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval
13.4.4
Certificates of Insurance
9.10.2
Change Orders
1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3,
7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1,
9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2
Change Orders, Definition of
7.2.1
CHANGES IN THE WORK
2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1,
11.5
Claims, Definition of
15.1.1
Claims, Notice of
1.6.2, 15.1.3
CLAIMS AND DISPUTES
3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4
Claims and Timely Assertion of Claims
15.4.1
Claims for Additional Cost
3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**
Claims for Additional Time
3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**
Concealed or Unknown Conditions, Claims for
3.7.4
Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3,
11.3.2, 14.2.4, 15.1.7
Claims Subject to Arbitration
15.4.1
Cleaning Up
3.15, **6.3**
Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3,
6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**
Commencement of the Work, Definition of
8.1.2
Communications
3.9.1, **4.2.4**
Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1,
9.10, 12.2, 14.1.2, 15.1.2
COMPLETION, PAYMENTS AND
9
Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1,
9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2,
13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3,
15.2.8, 15.4.2, 15.4.3
Concealed or Unknown Conditions
3.7.4, 4.2.8, 8.3.1, 10.3
Conditions of the Contract
1.1.1, 6.1.1, 6.1.4

Consent, Written
3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2,
15.4.4.2
Consolidation or Joinder
15.4.4
CONSTRUCTION BY OWNER OR BY
SEPARATE CONTRACTORS
1.1.4, **6**
Construction Change Directive, Definition of
7.3.1
Construction Change Directives
1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3,
7.3, 9.3.1.1
Construction Schedules, Contractor's
3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Contingent Assignment of Subcontracts
5.4, 14.2.2.2
Continuing Contract Performance
15.1.4
Contract, Definition of
1.1.2
CONTRACT, TERMINATION OR
SUSPENSION OF THE
5.4.1.1, 5.4.2, 11.5, **14**
Contract Administration
3.1.3, 4, 9.4, 9.5
Contract Award and Execution, Conditions Relating
to
3.7.1, 3.10, 5.2, 6.1
Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3
Contract Documents, Definition of
1.1.1
Contract Sum
2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4,
9.1, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2,
12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**
Contract Sum, Definition of
9.1
Contract Time
1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5,
7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7.3.10, 7.4, 8.1.1,
8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2,
14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5
Contract Time, Definition of
8.1.1
CONTRACTOR
3
Contractor, Definition of
3.1, **6.1.2**
Contractor's Construction and Submittal
Schedules
3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2
Contractor's Employees
2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6,
10.2, 10.3, 11.3, 14.1, 14.2.1.1
Contractor's Liability Insurance
11.1

Contractor's Relationship with Separate Contractors and Owner's Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4

Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1

Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor's Responsibility for Those Performing the Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor's Review of Contract Documents
3.2

Contractor's Right to Stop the Work
2.2.2, 9.7

Contractor's Right to Terminate the Contract
14.1

Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3

Contractor's Superintendent
3.9, 10.2.6

Contractor's Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4

Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11

Copyrights
1.5, **3.17**

Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1

Correlation and Intent of the Contract Documents
1.2

Cost, Definition of
7.3.4

Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14

Cutting and Patching
3.14, 6.2.5

Damage to Construction of Owner or Separate Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7

Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2

Date of Commencement of the Work, Definition of
8.1.2

Date of Substantial Completion, Definition of
8.1.3

Day, Definition of
8.1.4

Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification
9.4.1, **9.5**, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance, Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1

Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time
3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, **9.5.1**, **9.7**, 10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission
1.7

Disputes
6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site
3.11

Drawings, Definition of
1.1.5

Drawings and Specifications, Use and Ownership of
3.11

Effective Date of Insurance
8.2.2

Emergencies
10.4, 14.1.1.2, **15.1.5**

Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1

Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, **15.2.5**

Failure of Payment
9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Faulty Work
(See Defective or Nonconforming Work)

Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's

2.2.1, 13.2.2, 14.1.1.4

GENERAL PROVISIONS

1

Governing Law

13.1

Guarantees (See Warranty)

Hazardous Materials and Substances

10.2.4, **10.3**

Identification of Subcontractors and Suppliers

5.2.1

Indemnification

3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,

9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,

14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of

1.1.8

Initial Decision Maker, Decisions

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

10.2.8, 10.4

Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,

9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders

1.1.1

Instructions to the Contractor

3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of

1.1.7

Insurance

6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5,

11

Insurance, Notice of Cancellation or Expiration

11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1

Insurance, Effective Date of

8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property

10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials

9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy

9.9.1

Insured loss, Adjustment and Settlement of

11.5

Intent of the Contract Documents

1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation

1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written

4.2.11, 4.2.12

Judgment on Final Award

15.4.2

Labor and Materials, Equipment

1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,

10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes

8.3.1

Laws and Regulations

1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,

9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,

15.4

Liens

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of

12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability

3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,

4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,

11.3, 12.2.5, 13.3.1

Limitations of Time

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,

5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,

9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,

15.1.2, 15.1.3, 15.1.5

Materials, Hazardous

10.2.4, **10.3**

Materials, Labor, Equipment and

1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,

10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and

Procedures of Construction

3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Mediation

8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,

15.4.1.1

Minor Changes in the Work

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7,

10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4,
12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4,
3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4,
8.2.2 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1,
13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5,
15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance
11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5,
15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections
13.4.1, 13.4.2

Observations, Contractor's
3.2, 3.7.4

Occupancy

2.3.1, 9.6.6, 9.8

Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2,
14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5,
9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1,
13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2,
4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1,
7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2,
10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4,
15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

**Owner's Right to Perform Construction and to
Award Separate Contracts**

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

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

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12,
5.3

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1,
14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1,
9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Project, Definition of

1.1.4

Project Representatives

4.2.10

Property Insurance

10.2.5, **11.2**

Proposal Requirements

1.1.1

PROTECTION OF PERSONS AND PROPERTY 10

Regulations and Laws

1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Rejection of Work

4.2.6, 12.2.1

Releases and Waivers of Liens

9.3.1, 9.10.2

Representations

3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1

Representatives

2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1

Responsibility for Those Performing the Work

3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10

Retainage

9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

Review of Contract Documents and Field Conditions by Contractor

3.2, 3.12.7, 6.1.3

Review of Contractor's Submittals by Owner and Architect

3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2

Review of Shop Drawings, Product Data and Samples by Contractor

3.12

Rights and Remedies

1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2, 12.2.4, 13.3, 14, 15.4

Royalties, Patents and Copyrights

3.17

Rules and Notices for Arbitration

15.4.1

Safety of Persons and Property

10.2, 10.4

Safety Precautions and Programs

3.3.1, 4.2.2, 4.2.7, 5.3, 10.1, 10.2, 10.4

Samples, Definition of

3.12.3

Samples, Shop Drawings, Product Data and

3.11, 3.12, 4.2.7

Samples at the Site, Documents and

3.11

Schedule of Values

9.2, 9.3.1

Schedules, Construction

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Separate Contracts and Contractors

1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2

Separate Contractors, Definition of

6.1.1

Shop Drawings, Definition of

3.12.1

Shop Drawings, Product Data and Samples

3.11, 3.12, 4.2.7

Site, Use of

3.13, 6.1.1, 6.2.1

Site Inspections

3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4

Site Visits, Architect's

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Special Inspections and Testing

4.2.6, 12.2.1, 13.4

Specifications, Definition of

1.1.6

Specifications

1.1.1, 1.1.6, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14

Statute of Limitations

15.1.2, 15.4.1.1

Stopping the Work

2.2.2, 2.4, 9.7, 10.3, 14.1

Stored Materials

6.2.1, 9.3.2, 10.2.1.2, 10.2.4

Subcontractor, Definition of

5.1.1

SUBCONTRACTORS

5

Subcontractors, Work by

1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7

Subcontractual Relations

5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1

Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3

Submittal Schedule

3.10.2, 3.12.5, 4.2.7

Subrogation, Waivers of

6.1.1, 11.3

Substances, Hazardous

10.3

Substantial Completion

4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2

Substantial Completion, Definition of

9.8.1

Substitution of Subcontractors

5.2.3, 5.2.4

Substitution of Architect

2.3.3

Substitutions of Materials

3.4.2, 3.5, 7.3.8

Sub-subcontractor, Definition of

5.1.2

Subsurface Conditions

3.7.4

Successors and Assigns

13.2

Superintendent

3.9, 10.2.6

Supervision and Construction Procedures

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

Suppliers

1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1

Surety

5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7

Surety, Consent of

9.8.5, 9.10.2, 9.10.3

Surveys

1.1.7, 2.3.4

Suspension by the Owner for Convenience

14.3

Suspension of the Work

3.7.5, 5.4.2, 14.3

Suspension or Termination of the Contract

5.4.1.1, 14

Taxes

3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor

14.1, 15.1.7

Termination by the Owner for Cause

5.4.1.1, 14.2, 15.1.7

Termination by the Owner for Convenience

14.4

Termination of the Architect

2.3.3

Termination of the Contractor Employment

14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT

14

Tests and Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.4

TIME

8

Time, Delays and Extensions of

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK

12

Uncovering of Work

12.1

Unforeseen Conditions, Concealed or Unknown

3.7.4, 8.3.1, 10.3

Unit Prices

7.3.3.2, 9.1.2

Use of Documents

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site

3.13, 6.1.1, 6.2.1

Values, Schedule of

9.2, 9.3.1

Waiver of Claims by the Architect

13.3.2

Waiver of Claims by the Contractor

9.10.5, 13.3.2, 15.1.7

Waiver of Claims by the Owner

9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, 15.1.7

Waiver of Consequential Damages

14.2.4, 15.1.7

Waiver of Liens

9.3, 9.10.2, 9.10.4

Waivers of Subrogation

6.1.1, 11.3

Warranty

3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2

Weather Delays

8.3, 15.1.6.2

Work, Definition of

1.1.3

Written Consent

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2

Written Interpretations

4.2.11, 4.2.12

Written Orders

1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or

relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable 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. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as

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

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

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

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 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.

§ 3.4 Labor and Materials

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

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 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

§ 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.

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

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 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.

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and

similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval 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.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 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.

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

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

§ 4.2.4 Communications

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

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

§ 4.2.6 The Architect 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 inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the 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, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in

number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a Separate Contractor or the subcontractors of a Separate Contractor.

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

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

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

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

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

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

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

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

§ 7.1.2 A Change Order shall be based 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. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

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

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

- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

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

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

- .1 defective Work not remedied;
 - .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
 - .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
 - .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
 - .5 damage to the Owner or a Separate Contractor;
 - .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- or

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

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

- .1 employees on the Work and other persons who may be affected thereby;

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

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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 notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed

by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the

procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

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

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect

timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract

Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

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

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work

properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract 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 and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall 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.

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

§ 15.1.6.2 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.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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

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

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

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

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

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party

provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Colfax City Hall Remodel
- B. Owner's Name: City of Colfax.
- C. Architect's Name: INVISION Architecture.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.03 DESCRIPTION OF WORK

- A. The **Colfax City Hall Renovation** project includes the following work:
 - 1. Renovation of approximately 7500 square feet of an existing one-story building. The renovation consists of concrete slabs on grade repair, built up metal framed floors, wood truss repairs, minor roofing investigation and repair, masonry repair, fire suppression systems and alarms, new mechanical system using new condenser units, plumbing system and fixtures, new electrical system and lighting fixtures, and technology components. The renovation of the existing space consists of minor interior demolition, new interior stud walls, new doors and frames, new casework, interior finishes. Site work consists of minor demolition of existing site components, new pavers, utilities replacement, stormwater management, minor grading and seeding.
- B. Scope of demolition and removal work is shown on drawings and specified in Section 02 41 00.
- C. Scope of alterations and new construction work is shown on drawings.
- D. Services (Including but not limited to Plumbing, HVAC, Electrical Power and Lighting, Fire Protection, Telecommunications, and Security): Alter existing system and add new construction, keeping existing in operation.
- E. Owner will remove the following items before start of work:
 - 1. Furnishings.
 - 2. Artwork.
 - 3. Portable equipment.
- F. Contractor shall remove and deliver the following to Owner prior to start of work:
 - 1. Wood ceiling item.

1.04 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner (OFOI) after Substantial Completion. Some items include:
 - 1. Movable cabinets.
 - 2. Furnishings.
 - 3. Small equipment.
 - 4. Artwork.
 - 5. Medical Equipment.
 - 6. Signage.
 - 7. Low-voltage cabling (including card readers)
 - 8. Data equipment at IT room
- B. Owner will supply and install the following:
 - 1. Toilet Accessories as identified in Section 102800.
- C. Owner will supply the following for installation by Contractor (OFCI):
 - 1. Breakroom kitchen appliances that require utility connections.

2. Toilet Accessories as identified in Section 102800.

1.05 OWNER-FURNISHED ITEMS

- A. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.
- B. 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.
- C. If Owner-furnished items are damaged, defective or missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field services, and the delivery of manufacturer's warranties and bonds to the Contractor.
- D. 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.
- E. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:
 1. Work by Others.
 2. Work by Owner.
 3. Adjacent building and/or tenant operations.
- C. Provide access to and from site as required by law and by Owner:
 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Time Restrictions:
 1. Limit conduct of especially noisy, malodorous, and dusty exterior work to the hours of 7 am to 7 pm, or no limit with approval by building owner.
- E. Utility Outages and Shutdown:
 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 2. Limit shutdown of utility services to length of time as agreed upon per instance, arranged at least 24 hours in advance with Owner.
 3. Prevent accidental disruption of utility services to facilities.

1.07 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.
- B. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- C. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- E. Execute cutting and patching to integrate elements of Work, uncover ill-timed, defective, and non-conforming Work, provide openings for penetrations of existing surfaces, and provide samples for testing if required. Seal penetrations through floors, walls, and roof.

1.08 DEFINITIONS AND EXPLANATIONS

- A. Imperative language is used generally in the specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor as if preceded by the phrase "The Contractor shall".
- B. The term "provide" means furnish and install, complete, and ready for intended use. Except as otherwise defined in greater detail, the term "furnish" means supply and deliver to the project site, including unloading, unpacking, inspecting, and storing until ready for receipt by Owner, installation, etc., as applicable.
- C. Except as otherwise defined in greater detail, the term "install" is used to describe operations at project site including assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations, as applicable.
- D. The term "indicated" is as cross-reference to graphics, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shows", "noted", "schedules", and "specified" are used in lieu of "indicated", it is for purpose of helping reader locate cross-reference, and no limitations of location is intended.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- A. Section 00 50 00 - Contracting Forms and Supplements: Forms to be used.
- B. Section 00 52 00 - Agreement Form: Contract Sum, retainages, payment period.
- C. Section 00 72 00 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- D. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.
- F. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.

- 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 30 00.
 - 2. Construction progress schedule, revised and current as specified in Section 01 30 00.
 - 3. Partial release of liens from major subcontractors and vendors.
 - 4. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
 - 5. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a estimated price quotation within 14 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 60 00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
 - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.

1. Provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cash allowances.
- B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

- A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH ALLOWANCES

- A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts.
- B. Architect Responsibilities:
 - 1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
 - 3. Prepare Change Order.
- C. Contractor Responsibilities:
 - 1. Assist Architect in selection of products, suppliers, and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- D. Differences in costs will be adjusted by Change Order.

1.04 CONTINGENCY ALLOWANCE

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- B. Funds will be drawn from the Contingency Allowance only by Change Order.
- C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.05 ALLOWANCES SCHEDULE

- A. Allowance No. 01: Include in the bid amount a cash allowance of \$15,000 for owner or architect directed changes during the construction period associated with Specification Divisions 2-14.
- B. Allowance No. 02: Include in the bid amount a cash allowance of \$10,000 for additional or changes to doors, frames and hardware.
- C. Allowance No. 03: Include in the bid amount a cash allowance of \$10,000 for owner or engineer directed changes during the construction period associated with Division 22 - Plumbing.
- D. Allowance No. 04: Include in the bid amount a cash allowance of \$10,000 for owner or engineer directed changes during the construction period associated with Division 23 - HVAC
- E. Allowance No. 05: Include in the bid amount a cash allowance of \$15,000 for owner or engineer directed changes during the construction period associated with Division 26, 27 & 28.
- F. Allowance No. 06: Include in the bid amount a cash allowance of \$10,000 for owner or architect directed changes during the construction period associated with Specification Divisions 31-33.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 RELATED REQUIREMENTS

- A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Unit Prices.
- B. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.
- B. Unsatisfactory soils are soils that are deemed by the geotechnical engineer as unsuitable for construction purposes. The geotechnical engineer is the sole judge of suitability of existing soil.

1.04 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.05 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Documents are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.
- B. A schedule of unit prices is included below. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

1.06 MEASUREMENT OF QUANTITIES

- A. The quantity of over-excavation shall be based upon calculated volume between the bottom of foundation and the bottom of over-excavation.
- B. A registered engineer, surveyor, or inspections agency, selected and paid for by the Owner and approved by the Architect, shall provide cross sections and quantity calculations for determining the actual amount of over-excavation.
 - 1. Cross sections shall be taken as necessary to obtain accurate quantities.
 - 2. Foundations: Elevations are required on both the bottom of foundation as well as the bottom of over-excavation. Horizontal limits of over excavation beyond foundation perimeter shall be equal to the width of the foundation for backfill consisting of lean concrete/flowable fill and shall be equal to 2/3 times the depth of excavation for backfill consisting of engineered granular fill. No compensation shall be made for horizontal excavations beyond these limits.
 - 3. Slabs: Elevations are required on both the resulting subgrade after topsoil stripping operations as well as the bottom of over excavation.
 - 4. Calculate quantities based upon the Average End Area Method.
 - 5. Shrink/swell factors shall not be considered part of these calculations or quantities.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.

- D. 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.
- E. 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.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- K. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes

1.07 PAYMENT

- A. Payment for Work governed by unit prices will be made for a variance from the quantity specified, on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for excess excavation work that is not specifically authorized by the Geotechnical Engineer.
- C. Payment will not be made for any of the following:
 - 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.

1.08 SCHEDULE OF UNIT PRICES

- A. Item 01: Masonry Cleaning; Section 04 01 10 - Masonry Cleaning.
 - 1. Unit of Measure: per Square Foot (SF)
- B. Item 02: Replacement of Brick; Section 04 01 20 - Maintenance of Masonry.
 - 1. Unit of Measure: per brick
- C. Item 03: Masonry Repointing; Section 04 01 20 - Maintenance of Masonry.
 - 1. Unit of Measure: per Lineal Foot (LF)
- D. Item 04: Roof Repair; Section 07 01 50.19 - Roofing Repair and Replacement
 - 1. Unit of Measure: per Square Foot (SF)

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 23 00
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.
- C. Documentation of changes to Contract Sum and Contract Time.

1.02 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

- A. Alternate No. 01 - Snow Melt:
 - 1. Base Bid: no snow-melt system
 - 2. Alternate Item: Add 500 SF of snow-melt system to the sidewalk in front of the building.
- B. Alternate No. 02 - Storage 118 Construction:
 - 1. Base Bid: Construct Storage 118 with 3-hour metal stud walls and gypsum board ceiling as indicated in drawings
 - 2. Alternate Item: Construct Storage 118 with 3-hour cmu walls and precast concrete lid.
- C. Alternate No. 03 - Countertops:
 - 1. Base Bid: Provide quartz countertops as indicated in drawings.
 - 2. Alternate Item: Provide plastic laminate countertops in lieu of quartz.
- D. Alternate No. 04 - Generator:
 - 1. Base Bid: No generator.
 - 2. Alternate Item: Add generator, dedicated panel, and structural platform expansion at north alley, as indicated in drawings as Alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Coordination drawings.
- G. Submittals for review, information, and project closeout.
- H. Number of copies of submittals.
- I. Requests for Interpretation (RFI) procedures.
- J. Submittal procedures.
- K. Release of CAD/BIM files

1.02 RELATED REQUIREMENTS

- A. Section 00 72 00 - General Conditions: Dates for applications for payment.
- B. Section 01 60 00 - Product Requirements: General product requirements.
- C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

1.04 PROJECT COORDINATOR

- A. Project Coordinator: General Contractor.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site and existing building access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for Interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via Internet-based submittal service.
 - 1. The web-based software will provide status logs, reports, searching and automated notifications.
 - 2. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts, which shall be delivered by mail or courier.
- B. Submittal Service (if used): The selected service is:
 - 1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
 - 2. EADOC LLC (tel: 1-877-305-3844): www.eadocsoftware.com/#sle.
 - 3. Newforma Project Cloud: www.newformaprojectcloud.com; 800-303-4650; projectcloud@newforma.com
 - 4. Other provided by General Contractor, and approved by Architect and Owner, prior to Bid.
- C. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 RELEASE OF CAD/BIM FILES

- A. Contractors may request plans for their use/benefit for assistance in preparing submittals or for use in construction.
 - 1. Standard charge is \$100 (flat rate), payable directly to the Architect, for Architect's cost in developing CAD files.
 - 2. The Revit model will be provided at no charge.
 - 3. If CAD files, contractor shall identify specific sheets to be produced as files.
 - 4. A signed release form is required. See waiver immediately following this section.

3.03 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Major subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Designation of personnel representing the parties to Contract, the Owner's Representative and Architect.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Scheduling.
- D. General Contractor will record minutes and distribute copies within 7 days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.
 - 1. Minutes will be distributed through Web-based project management software system.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect, at frequency per Owner-Architect agreement.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
 - 6. Major Suppliers.
 - 7. Additional consultants, subcontractors, suppliers and product representatives as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to work.
- E. Contractor will record minutes and distribute copies within 5 days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.
1. Minutes will be distributed through Web based project management software system

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first ____ days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Submit updated schedule with each Application for Payment.

3.06 COORDINATION DRAWINGS

- A. Provide information required by Project Coordinator for preparation of coordination drawings.
- B. Review drawings prior to submission to Architect.

3.07 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare using software provided by the Electronic Document Submittal Service (if used).
 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

- d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
- 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
 - 5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within 2 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.08 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 1. Coordinate with Contractor's construction schedule and schedule of values.
 2. Format schedule to allow tracking of status of submittals throughout duration of construction.
 3. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.09 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
 5. Other types indicated.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.10 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.
- C. Daily Log: Submit to Owner through Architect two (2) copies of Contractor's daily log indicating all personal on-site including names and time on site. Submit at maximum of monthly intervals at progress meetings and immediately upon request of Owner

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.

4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
1. Transmit to Architect/ Engineer via Electronic Document Submittal Service.
- B. Extra Copies at Project Closeout: See Section 01 78 00.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. Retained samples will not be returned to Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

- A. General Requirements:
1. Use a single transmittal for related items.
 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 3. Transmit using approved form.
 - a. Use Contractor's form, subject to prior approval by Architect.
 - 1) Or use form generated by Electronic Document Submittal Service software.
 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 8. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 10. Provide space for Contractor and Architect review stamps.
 11. When revised for resubmission, identify all changes made since previous submission.
 12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 14. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.

2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.
- E. Submittals shall be numbered by Specification section and sequence: ie 23 5243 - 1, 23 5243-2. Revise submittals with original number and a sequential alphabetic suffix.

3.14 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Make Corrections Noted", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - 2) Non-responsive resubmittals may be rejected.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- J. Manufacturers' field services.
- K. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 00 50 00 - Contracting Forms and Supplements
- B. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.
- C. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- D. Section 01 45 33 - Code-Required Special Inspections and Testing;
- E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

1.04 DEFINITIONS

- A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:
 - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
 - b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary bracing.
 - 4. Temporary falsework for support of spanning or arched structures.
 - 5. Temporary stairs or steps required for construction access only.

6. Temporary hoist(s) and rigging.
7. Investigation of soil conditions to support construction equipment.

1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 1. Concrete Mix Design: As described in Section 03 30 00 - Cast-in-Place Concrete. No specific designer qualifications are required.
 2. Concrete Mix and Structural Design: As described in Section 03 41 13 - Precast Concrete Hollow Core Planks.
 3. Structural Design of Metal Fabrications: As described in Section 05 50 00 - Metal Fabrications.
 4. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 43 13 - Aluminum-Framed Storefronts.

1.07 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

1.08 QUALITY ASSURANCE

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a

Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.09 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. See Section 014533 - Code-Required Special Inspections and Testing for additional information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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 manufacturers' instructions conflict with Contract Documents, request clarification from Architect 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. Have work performed 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, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

- C. Notify Architect and Architect's Consultant fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
- G. Accepted mock-ups shall be a comparison standard for the remaining Work.
- H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- I. Where possible salvage and recycle the demolished mock-up materials.

3.03 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 before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 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 applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 43 39
MOCKUP REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for mockups of identified critical systems and assemblies for this project.
- B. Construct one assembly or location of each of the following and allow for review by the Owner and Architect before proceeding with additional work. Adjust installation and assembly techniques as required to meet requirements of the Contract Documents, the Owner, and the Architect. Do not perform additional work until approval is received.
- C. Refer to the individual product sections for more detailed descriptions of each mock-up assembly, and for whether approved mock-ups may remain as part of the work.
 - 1. Masonry Cleaning
 - 2. Maintenance of Masonry
 - 3. Firestopping.
 - 4. Tiling - wall and floor tiling; 2 feet by 2 feet by 2 feet, including patterns, grout and edge components.
 - 5. Tile Carpeting - 16 x 16 feet, loose laid.
 - 6. Interior Painting - 100 square feet of a single color on block wall
 - 7. High Performance Coatings - 2 x 2 feet for each substrate
 - 8. Applied Graphics - 6 x 10 feet, to illustrate design intent.

1.02 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete
- B. Section 03 35 11 - Concrete Floor Finishes
- C. Section 04 01 10 - Masonry Cleaning
- D. Section 04 01 20 - Maintenance of Masonry
- E. Section 07 84 00 - Firestopping
- F. Section 07 92 00 - Joint Sealants
- G. Section 09 30 00 - Tiling
- H. Section 09 68 14 - Tile Carpeting
- I. Section 09 90 00 - Painting
- J. Section 09 96 00 - High-Performance Coatings

1.03 SUBMITTALS

- A. Comply with the requirements of individual Sections for submittals required. Do not proceed with mockups until submittals have been reviewed and approved.

1.04 DEFINITIONS

- A. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the

following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: construct integrated exterior mock-up as indicated above. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Work shall be performed by the same personnel who will work on the rest of the project.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work.
- H. Accepted mock-ups shall be a comparison standard for the remaining Work.
- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- J. Where possible salvage and recycle the demolished mock-up materials.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dewatering
- B. Temporary utilities: Electricity, lighting, heat, ventilation.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers and enclosures.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Project identification sign.
- J. Field offices.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.03 DEWATERING

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.
- B. Maintain temporary facilities in operable condition.

1.04 GENERAL

- A. Install temporary facilities and utilities in conformance with State and Local Codes and requirements.
- B. Trade Contractors to obtain and pay for required applications, permits and inspections.
- C. Early Service: Any Contractor requiring temporary service before it can be provided as specified, or whose requirements with respect to a particular service differ from the service specified shall provide such service as suits his needs, at his own expense, and in a manner satisfactory to the General Contractor.
- D. Maintenance: Temporary facilities and utilities are to be maintained and kept in good operating condition. Maintenance men necessary to perform this work shall be provided in accordance with requirements. Maintenance time will include normal working hours for all trades and start up and shut down overtime as required.
- E. Removals: Subject to approval of General Contractor, contractor providing temporary facilities or services shall remove same when no longer required or when their function is replaced by authorized use of permanent facilities. Other removal time may be directed by General Contractor.
- F. Install temporary work in such a manner as not to interfere with the permanent construction.
- G. Disclaimer: Specific administrative and procedural minimum actions are specified in this section, as extension of provisions in General Conditions and other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Architect, Engineer or General Contractor that such temporary activity is not required for successful completion of the work and compliance with requirements of contract documents. Provisions of this section are applicable to, but not by

way of limitation, utility services, construction facilities, security/protection provisions, and support facilities.

H. Use of permanent systems and facilities:

1. Obtain written agreement with Owner, establishing start of warranties and conditions of use:
 - a. Systems complete, with utility connections and safety devices.
 - b. Automatic controls operational.
 - c. Temporary filters and items required for protection of equipment and finishes are in place.
 - d. Replace items damaged during temporary service use.

1.05 TEMPORARY UTILITIES

A. Owner will provide the following:

1. Electrical power, consisting of connection to existing facilities.
2. Water supply, consisting of connection to existing facilities.

B. Provide and pay for all lighting, heating and cooling, and ventilation required for construction purposes.

1. General Responsibilities: Temporary heating responsibilities and equipment types relate to the extent of building enclosure and work performed as follows:
 - a. Permanent Enclosure: Temporary heat of the building after the building is permanently enclosed and approved as such by the Architect, shall be provided by the General Contractor. Permanent enclosure is defined as permanent walls, roofs, copings, and flashings in place and weathertight, windows in place and glazed and all entrance enclosures either permanently in place or provided with suitable temporary enclosures.
 - 1) Equipment: Temporary construction heaters, indirect fire heaters.
 - 2) Cost: Cost of fuel and electric power consumed paid for by the Construction Manager to be reimbursed for the full cost by the Owner.
 - 3) Work Restrictions: None except as may be stated in separate Specification Sections or required by the manufacturer, such as special ventilation requirements.
2. Ventilation: The Mechanical Contractor shall provide ventilation for the building and to prevent building up of harmful dusts and fumes and to remove excess moisture. During warm weather, provide an adequate supply of fresh air (minimum 1 to 1-1/2 air changes per hour) when necessary to properly ventilate for moisture, dust, fumes from paints, cements, or adhesives in tightly enclosed area where natural ventilation will not be sufficient. Ventilation requirements may be supplemented by the building's permanent HVAC system but primary responsibility rests with the designated trade contractor.
3. Mechanical Trade Contractor Responsibilities:
 - a. Maintain as to temperatures and ventilation required for work in various parts of the building as follows:
 - 1) Stored Materials: As recommended by manufacturer.
 - 2) Installed Materials: As recommended by manufacturer for the length of time following installation.
 - b. Maintain that portion of any floor thereof which has been constructed, or partly constructed, at a temperature and humidity that will ensure against damage due to warping, buckling, excessive shrinkage, etc., and adequate ventilation until the permanent HVAC system is operating. Trade Contractor will be responsible for damage to work under other contracts due to smoke or other damage caused by improper temporary heating.
 - c. Installation, connection, operation, and maintenance of temporary heating and ventilating devices to be performed by tradesmen proficient in the skills required and meet requirements of applicable regulator agencies.
 - d. Temperature Requirements:

- 1) Provide temperatures required in various parts of the buildings as specified herein below:
 - 2) All Trades: provide the range of temperatures required for temporary heat, so the temperature as recommended by the manufacturer of the material concerned is maintained while such materials as mentioned above are stored in the building or being installed, and for the length of time recommended following installation. In those portions of the building where work is in progress or completed, it must be protected from freezing if subject to damage there from.
4. During General Contract Work: Provide the following:
- a. During installation of gypsum wallboard or gypsum lath, a temperature of not less than 55 deg F during working hours, and a temperature of at least 40 deg F at all other times throughout the heating season.
 - b. Wall before plaster work or joint work for gypsum wall board begins and continuous throughout setting and drying periods, a temperature range between 50 and 75 deg F shall be maintained day and night. During this period, no finish woodwork, resilient flooring or flexible wall coverings shall be installed or stored in the buildings, and no finish painting or applying of finish wall coatings shall be undertaken.
 - c. For a period of 10 days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until fully occupied by the Owner, provide sufficient heat to produce a temperature of not less than 60 deg F.
5. Permanent Systems:
- a. Ten days prior to setting millwork and/or wood doors and when approved by Architect, use and maintain the permanent HVAC system for heating, cooling and ventilation. The amount of time the permanent system will be used during the construction project should be at most four months. Maintenance shall include the following:
 - 1) Proper operation and maintenance of the HVAC plant until acceptance of building by Owner.
 - 2) Maintenance of temporary filters in all equipment to prevent accumulation of dust and dirt in coils, housing, and ductwork.
 - 3) Prior to Final Inspection: Replacement of all (temporary and existing) filters with new filters, thorough cleaning of coils and other equipment, putting entire system into first class condition, cleaning traps and devices, adjustment and renewal of all materials and equipment not functioning correctly.
 - 4) Use of permanent heating or cooling equipment for temporary heating or cooling shall not affect guarantee. Guarantee shall take effect at time of building acceptance by Owner. Mechanical contractor to provide extended warranty as needed.
 - 5) Cost of all fuel for operation of permanent heating system shall be paid by the General Contractor and be reimbursed in full by the Owner.
 - b. Close off return air to the permanent systems and provide only single-pass air during the course of construction. This practice shall remain in place until area is clean and system is ready for final balancing.
 - c. Replace filters in all equipment to prevent accumulation of dust and dirt in coils, housings, and ductwork.
6. Prior to Final Inspection:
- a. Replace temporary filters with new filters.
 - b. Thoroughly clean coils and other equipment.
 - c. Clean traps and devices, adjust and renew any and all materials and equipment not functioning correctly.
 - d. Vacuum clean the duct system.
 - e. Restore equipment to like new condition.
- C. Temporary light and power:
1. Each Trade Contractor:

- a. Provide temporary light and power for its own construction field office.
 - b. Provide and pay for its own extensions for lights or power tools beyond the receptacle outlets provided below.
- 2. Electrical Trade Contractor:
 - a. Provide temporary light and power distribution for construction purposes for all trades including the cost of running temporary service from the utility supply. The temporary lighting and power system shall comply with all applicable OSHA regulations.
 - 1) Temporary power to be sufficient to operate all "light tools" and equipment (electric arc welders excluded) and permanent building equipment including elevators and HVAC system.
 - 2) Additional temporary power required by other trades to be furnished, at their cost, up to the power available.
- 3. The electrical requirements for all temporary heating and ventilating systems shall be connected directly to the project temporary power system until the primary service is installed.

1.06 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Internet Connections: Minimum of one; DSL modem or faster.

1.07 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. New permanent facilities may not be used during construction operations.
- C. Maintain daily in clean and sanitary condition.
- D. At end of construction, return facilities to same or better condition as originally found.

1.08 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plants designated to remain. Replace damaged plants.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.09 EXTERIOR ENCLOSURES

- A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 INTERIOR ENCLOSURES

- A. Provide temporary partitions as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and acoustic panel sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - 1. STC rating of 35 in accordance with ASTM E90.
 - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Provide all shoring and bracing required for safety and proper execution of the work. Remove the items when the work is completed.

- D. Paint surfaces exposed to view from Owner-occupied areas.

1.11 WEATHER PROTECTION

- A. Protect work and existing or adjacent property against weather, to maintain their work, materials, apparatus and fixtures free from injury or damage in accordance with the General conditions during the entire construction period. Work damaged by failure to provide weather protection all be removed and replaced with new work at the contractor's expense.
- B. Provide temporary non-staining waterproof coverings to close-off cavities and shed water to exterior and lap wall assemblies not less than 4 inches. Maintain in watertight condition until permanent coverings are in place.
- C. Remove all snow and ice as may be required for proper protection and execution of the work and protect and safety of the public.

1.12 SECURITY

- A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.13 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.
- D. Provide and maintain access to fire hydrants, free of obstructions. Leave fire lanes and aisles to fire fighting equipment unobstructed at all times. Do not pile material in front of fire equipment, fire doors, or hydrants.
- E. Provide means of removing mud from vehicle wheels before entering streets.
- F. Designated existing on-site roads may be used for construction traffic.
- G. Construct and maintain temporary roads accessing public thoroughfares to serve construction area. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- H. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- I. Existing parking areas may be used for construction parking.
 - 1. Do not obstruct egress to and from parking areas unless authorized by Owner.
- J. Provide one parking space for Owner use.
- K. Provide one additional parking space for Visitor use.
- L. Parking of private vehicles of workers shall be in an area allocated by General Contractor and/or Owner.
 - 1. Review parking with Owner at Pre-Construction meeting. Closed alley or city-owned parking lot across the street from the project should be available.

1.14 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition. Locate in area designated by Owner and General Contractor.
- B. Provide containers with lids. Remove trash from site weekly, legally disposing of waste materials, debris and rubbish off site and off Owner's property.

- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- E. Remove waste materials, debris, and rubbish from building daily.
- F. Carts, trucks, etc. used to transport materials shall be loaded in a safe manner. Materials shall not protrude beyond the sides of conveyance used.
- G. Materials shall not be thrown or dropped from scaffolds or other overhead areas.
- H. Gasoline or other highly flammable liquids shall not be brought inside facilities.

1.15 PROJECT IDENTIFICATION

- A. Provide project identification sign of design, construction, and location approved by Owner.
 - 1. See drawings for design and construction. Location to be approved by Owner.
- B. No other signs are allowed without Owner permission except those required by law.

1.16 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table.
 - 1. Review proposed location within Project Site with Owner.
 - 2. Provide space for Project meetings, with table and chairs to accommodate 12 persons.
- B. Field Offices shall be maintained until final acceptance and then be removed by the responsible party, no later than fifteen (15) days after acceptance of building, unless the General Contractor orders or approves earlier removal.
- C. Expenses:
 - 1. General Contractor: All expenses in connection with his Field Offices, including the installation costs and use of telephones, heat, air-conditioning, light, water and janitor service shall be paid for by the General Contractor and will be fully reimbursed by the Owner.
 - 2. Trade Contractors: All expenses associated with their offices including utility installation costs shall be included in their bid.
 - 3. Toll Costs: All long distance calls to be paid for by party placing call including Architect, Owner's representative, and contractors.
- D. Each Trade Contractor: To keep a complete set of drawings, and specifications kept marked up to date with revision, Addenda, as-built drawings, and all permits and approved shop drawings on file.

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.
- B. Section 01 40 00 - Quality Requirements: Product quality monitoring.
- C. Section 01 60 10 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- D. Section 01 60 10.01 - Substitution Request Form

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.
 - 3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions.
 - 2. If wet-applied, have lower VOC content.
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 4. Result in less construction waste. See Section 01 74 19

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions:
Submit a request for substitution for any manufacturer not named.
1. See Section 01 60 10 - Substitution Procedures.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities as follows:
1. Section 08 71 00 - Door Hardware:
 - a. Change Keys per Cylinder: Two (2).
 - b. Master Keys (per Master Key Level/Group): Five (5).
 - c. Construction Keys (where required): Ten (10).
 2. Section 09 30 00 - Tiling:
 - a. Tile: 5% of total quantity installed of each size, color, and finish, but not less than 1 carton of each.
 3. Section 09 51 00 - Acoustical Ceilings:
 - a. Acoustical Tile: 5% of total quantity installed of each size, color, and finish, but not less than 1 carton of each.
 4. Section 09 65 00 - Resilient Flooring:
 - a. Flooring: 5% of total quantity installed of each size, color, and finish, but not less than 1 carton of each.
 - b. Rubber Base: 20 LF of each type and color.
 5. Section 09 68 13 - Tile Carpeting:
 - a. Carpet Tile: 5% of total quantity installed of each size, color, and pattern.
 6. Section 09 91 23 - Interior Paint
 - a. Paint: at least one gallon of each color, in all applicable sheens.
 7. Section 10 28 00 - Toilet Accessories
 - a. Four keys to each accessory.
- B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 60 10 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 60 10
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.
- B. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- C. Section 01 60 10.01 - Substitution Request Form

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution Requests made after contract award and for the Contractor's convenience will be subject to review fees, and possibly redesign fees, by the design team. These will be processed as a deductive change order to the contractor and paid to the design team by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms included in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing the form provided in Section 016011. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing the form provided in Section 01 60 11. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. Contractor is responsible for ensuring that the proposed substitution is of equal to or superior to the basis of design in performance, appearance, quality and function prior to Architect's review.
 - 2. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 3. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 4. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request. These will be processed as a deductive change order to the contractor and paid to the design team by the Owner.
 - b. Other construction by Owner.
 - c. Other unanticipated project considerations.
- D. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record.

END OF SECTION

SECTION 01 60 10.01
SUBSTITUTION REQUEST FORM

We hereby submit for your consideration the following product instead of the specified item for the following project:

PROJECT TITLE _____ PROJECT NO. _____

DRAWING NO. _____ DRAWING TITLE _____

SPEC. SECTION	SPEC. TITLE	PARAGRAPH	SPECIFIED ITEM
_____	_____	_____	_____

Proposed Substitution: _____

Attach complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Submit, with request, all necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance.

Substitutions of the materials and equipment described in the Contract Documents will be considered during the bidding period upon receipt or a written request to the Architect for approval up to ten (10) days before receipt of bids. Verbal or written requests without the completed Substitution Request Form will not be considered.

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned states that the function, appearance, and quality are equivalent or superior to the specified item.

Submitted by:

Signature

Firm

Address

Telephone

Email

Date

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

Fill in Blanks Below:

- A. Does the substitution affect dimensions shown on Drawings? Yes No

If yes, clearly indicate changes:

- B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution? Yes No

If no, fully explain:

C. What effect does substitution have on other Contracts or other trades?

D. What effect does substitution have on construction schedule?

E. Manufacturer's warranties of the proposed and specified items are:

_____ Same _____ Different (Explain on Attachment)

F. Reason for Request:

G. Itemized comparison of specified item(s) with the proposed substitution.

List significant variations:

H. Accurate cost data comparing proposed substitution with product specified:

I. Designation of maintenance services and sources:

(ATTACH ADDITIONAL SHEETS IF REQUIRED)

FOR USE BY DESIGN PROFESSIONAL:

_____ Recommended _____ Recommended as Noted

_____ Not Recommended _____ Received Too Late

Signed By _____

Date _____

FOR USE BY OWNER'S REPRESENTATIVE OR OWNER:

_____ Approved _____ Approved as Noted

_____ Not Approved _____ Approved Too Late

Signed By _____

Date _____

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties .

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Effect on work of Owner or separate Contractor.
 - f. Written permission of affected separate Contractor.
 - g. Date and time work will be executed.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- D. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

- A. See Section 01 10 00 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that 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. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 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 any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect five days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations, and addition roof elevation.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 2. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 10 00 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.

- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 - 2. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work tightly to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.09 PROTECTION OF EXISTING AND INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
 - 1. Minimum protection to include the following:
 - a. One layer of 1/4 inch thick fanfold board ("Amocor'PB4" by Amoco or equal) laid directly over roof.
 - b. One layer of nominal 1/2 inch thick exterior plywood or exterior OSB board laid over fanfold board. Provide suitable ballast to maintain position and preclude blow-off. Do not overload structure.
 - 2. After completion of work operations on roof, remove temporary protection, restore roof to pre-construction condition, and repair damage to roof, if any; see below.
 - a. Damage/Warranties: Damage to existing roofing due to operations under this Contract to be repaired as required by roofing membrane manufacturer without reduction in Owner's warranty provisions and rights:
 - b. All costs associated with repairs and warranty reinstatements, if any, to be borne by the Contractor who caused the damage.
 - c. Existing Warranties: Coordinate with Owner for areas of roof which carry existing warranty; repairs in these areas, if any, to be made by original installer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.

- E. Execute start-up under supervision of applicable Contractor personnel in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Replace filters of operating equipment.
- G. Clean debris from roofs and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
- J. Clean Owner-occupied areas of work.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Contractor and/or Owner on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 00 72 00 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 30 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form prior to final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.

- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 2. Field changes of dimension and detail.
 - 3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Include test and balancing reports.
- N. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Original warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Partial building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of building elements for alteration purposes.
- C. Abandonment and removal of existing utilities.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Sequencing and staging requirements.
- C. Section 01 10 00 - Summary: Description of items to be removed by Owner.
- D. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- E. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- F. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- G. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Vegetation to be protected.
 - 2. Areas for temporary construction and field offices.
 - 3. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Schedule of building demolition activities with starting and ending dates for each activity.
 - 3. Include measures for environmental protection, for dust control, and for noise control.
 - 4. Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.
 - 5. Include a summary of safety procedures.
- D. Inventory of items that have been removed and salvaged.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.06 QUALITY ASSURANCE

- A. Standards: Comply with ASSE A10.6 and NFPA 241.

1.07 FIELD CONDITIONS

- A. Spaces immediately adjacent to demolition area will be occupied. Conduct demolition so operations of occupied spaces will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied spaces.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent spaces.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent spaces without written permission from authorities having jurisdiction.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Design Professional and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. On-site storage or sale of removed items or materials is not permitted.
- E. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

- A. Remove portions of existing building as indicated in demolition plans.
- B. Remove other items indicated, for salvage and relocation.
- C. Fill openings or penetrations as result of removals, firestop at rated walls as indicated in code plan.

3.02 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

3.03 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with other requirements specified in Section 01 70 00.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - a. Remove temporary barriers and protections where hazards no longer exist.
 - b. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.

8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
 - D. Do not begin removal until built elements to be salvaged or relocated have been removed.
 - E. Survey existing conditions of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations. Notify Design Professional of any concerns.
 - F. Protect existing structures and other elements that are not to be removed.
 1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
 - G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
 - H. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.04 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Contractor to coordinate utility shut-downs or disruptions with the Owner. Notices shall be as identified in Division 01 sections and as agreed to at Pre-Construction meeting.
- E. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- F. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 7 days prior notification to Owner.
- G. Verify that utilities have been disconnected and capped before starting demolition operations.
- H. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- I. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- J. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.05 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 1. Verify that construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Cooperate with the Owner and Authorities Having Jurisdiction to provide Interim Life Safety Measures (ILSM) in all areas affected by demolition or construction operations.

1. Ensure exits provide an unobstructed egress. Building areas under construction must maintain escape facilities for construction workers at all times. Provide alternate routes around closed or obstructed traffic-ways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
 3. Develop and enforce storage, housekeeping, and debris removal practices that reduce the flammable and combustible fire load of the building to the lowest level necessary for daily operations as stated in the general conditions.
 4. Provide hazard surveillance of building, grounds, and equipment with attention to construction areas, construction storage, and field offices.
 5. Follow NFPA 241 guidelines pertaining to safe-guarding for construction and demolition processes.
 6. Follow NFPA 1 guidelines pertaining to fire prevention measures.
- C. Structural Demolition:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 2. Maintain fire watch during and for at least 24 hours after flame-cutting operations minimum.
 3. Maintain adequate ventilation when using cutting torches.
- D. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- E. Salvaged Items: Comply with the following:
1. Clean salvaged items of dirt and demolition debris.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- F. Remove existing work as indicated and as required to accomplish new work.
1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 2. Remove items indicated on drawings.
 3. Inventory and record the condition of items to be removed and salvaged.
- G. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 3. Verify that abandoned services serve only abandoned facilities before removal.
 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- H. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch as specified for patching new work.

3.06 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
1. Do not allow demolished materials to accumulate on-site.

2. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 4. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 5. General Contractor will provide dumpster and coordinate with waste hauler for drop off and pick-up.
 6. Dumpster to be located as agreed upon at Pre-Bid meeting or as directed by Owner.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete floor patching.
- B. Concrete reinforcement.
- C. Miscellaneous concrete elements, including bonding and jointing products.
- D. Underslab vapor retarder.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings
- B. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: moisture and alkalinity testing and remediation, above slab vapor retarder.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- C. ACI 301 - Specifications for Structural Concrete.
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- F. ACI 308R - Guide to Curing Concrete.
- G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- H. ACI 347R - Guide to Formwork for Concrete.
- I. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- J. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).
- O. ASTM C150/C150M - Standard Specification for Portland Cement.
- P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
- Q. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
- S. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- T. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

- U. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- V. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- W. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- X. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- Y. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
- Z. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- AA. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- AB. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- AC. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
 - 3. Submit proposed concrete mix designs for review with field tests or design documentation to substantiated design strength for each concrete mixture. Submit alternate design mixtures when characteristics of material, Project conditions, weather, test results or other circumstances warrant adjustment.
- D. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.
 - 1. Form: Flat sheets or coiled rolls.
 - 2. Mesh Size: As indicated on drawings.

- 3. Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 2. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal or Type III - High Early Strength Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Where concrete is to be exposed to view, do not use aggregate containing iron or other staining elements.
 - 2. Fine aggregate for slab on grade and suspended slabs: In addition to requirements above, provide imported sand free of materials with deleterious reactivity to alkali in cement.
 - 3. Maximum Coarse-Aggregate Size: 1/3 slab thickness.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
 - 1. Products: "Emsac F 100" manufactured by Elkem Chemical, Inc; "Eucon MSA" manufactured by Euclid Chemical Company; "Force 10,000" manufactured by W. R. Grace and Co; or approved equivalent.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
 - 1. Products: "MB-VR" manufactured by BASF; "Air Mix" manufactured by Euclid Chemical Company; "Darex Series" manufactured by W. R. Grace and Co; or approved equivalent
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
 - 1. Products: "Glenium Series" manufactured by BASF; "Eucon 537" manufactured by Euclid Chemical Company; "Daracem Series" manufactured by W. R. Grace and Co; or approved equivalent.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
 - 1. Products: "Rheobuild 1000" manufactured by BASF; "Eucon 37" manufactured by Euclid Chemical Company; "Daracem Series" manufactured by W. R. Grace and Co; or approved equivalent.
- E. Non-Chloride, Non-Corrosive Accelerating Admixture: ASTM C494/C494M; Type C or E, and not contain more chloride ions than are present in municipal drinking water.
 - 1. Products: "Pozzolith NC 534" manufactured by BASF; "Accelguard 80" manufactured by Euclid Chemical Company; "Daraset Series" manufactured by W. R. Grace and Co; or approved equivalent.
- F. Water Reducing Admixture: ASTM C494/C494M Type A.
 - 1. Products: "Pozzolith Series" manufactured by BASF; "Eucon Series" manufactured by Euclid Chemical Company; "WRDA Hycol" manufactured by W. R. Grace and Co; or approved equivalent.
- G. Calcium chloride is not permitted.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

1. Application: vapor retarder under new slabs.
 - a. For existing slabs, provide topical vapor retarder as specified in Section 09 05 61.
2. Thickness: 15 mils, minimum
3. Permeance: less than 0.01 perms after mandatory conditioning tests per ASTM E1745 (7.1.1 to 7.1.5)
4. Installation: Comply with ASTM E1643.
5. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
6. Manufacturers:
 - a. Barrier-Bac: VB-350
 - b. Epro Services: Ecoshield E15
 - c. Flatiron Films: Iron Barr 15
 - d. Fortifiber Building Systems Group: www.fortifiber.com/#sle.
 - e. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
 - f. Raven Industries: VaporBlock VB15
 - g. Stego Industries, LLC; Stego Wrap 15 mil Class A: www.stegoindustries.com/#sle.
 - h. W. R. Meadows, Inc; PERMINATOR Class A - 10 mils (0.25 mm): www.wrmeadows.com/#sle.
 - i. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. Grout: Comply with ASTM C1107/C1107M.
 2. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 3. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
 1. Manufacturers:
 - a. Kaufman Products Inc; SureBond: www.kaufmanproducts.net/#sle.
 - b. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
 - c. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Epoxy Bonding System: for structural load-bearing applications and non-loadbearing applications where applied to damp surfaces or curing will occur under humid conditions
 1. Complying with ASTM C881/C881M and of Type required for specific application.
 2. Manufacturers:
 - a. Adhesives Technology Corporation; Crackbond SLV-302, Crackbond LR-321, Crackbond LR-321 LPL, Ultrabond 2100 LPL, Ultrabond 2100, Ultrabond 1, Ultrabond 2, or Ultrabond HS200: www.atcepoxy.com/#sle.
 - b. Euclid Chemical Company; DURALFLEX LV: www.euclidchemical.com/#sle.
 - c. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - d. Kaufman Products Inc; SurePoxym HM EPL: www.kaufmanproducts.net/#sle.
 - e. SpecChem, LLC; SpecPoxym 1000, SpecPoxym 2000, SpecPoxym 3000, or SpecPoxym 3000FS: www.specchemllc.com/#sle.
 - f. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com/#sle.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 CURING MATERIALS

- A. Moisture-Retaining Sheet: ASTM C171. Provide one of the following:
 1. Curing paper, regular or white.
 2. Polyethylene film, clear or white opaque, minimum nominal thickness of 4 mil, 0.004 inch.

3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
 1. Minimum compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
 2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 4. Silica Fume Content: Maximum 10 percent of cementitious materials by weight.
 5. Water-Cement Ratio: Maximum 45 percent by weight.
 6. Total Air Content: 6 percent, plus or minus 1.0 percent at point of delivery; determined in accordance with ASTM C173/C173M.
 - a. Do not allow air content of trowel finished floors to exceed 3 percent.
 7. Maximum Slump: As determined by ASTM C143 with tolerances as established by ASTM C94, and as follows:
 - a. Reinforced Footings, Substructure Walls, and Slabs: 3 inches.
 - b. Slump may be increased by the use of approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94/C94M. Concrete containing the high-range water-reducing admixture may have a maximum slump of 9 inches. The concrete shall arrive at the job site at a slump of 2 to 4 inches. This should be verified, and then high-range water-reducing admixture added to increase the slump to the approved level.
 8. Maximum Aggregate Size: Maximum aggregate size not to exceed one-fifth of the narrowest dimension between the sides of the forms, one-third of the depth of slabs, nor three quarters of the minimum clear spacing between individual reinforcing bars or prestressing tendons. Comply with requirements of ACI 318.
 9. Combination of Fly Ash, Slag and other Pozzolans: Maximum 50 percent, but not less than 40 percent of cementitious materials by weight.

2.09 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.
 1. Exception: If concrete batch ticket indicates that the amount of water in the mix design was not fully added at the plant, then that amount of water may be added under the direct supervision of the Owner's testing agency representative.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Tie into existing where possible. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Clean reinforcement of loose rust and mill scale, earth, ice and other foreign materials.
- C. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- E. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
 - 1. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.04 PLACING CONCRETE

- A. Do not add water to concrete during delivery or at Project site, except as follows: If concrete batch ticket indicates that the amount of water in the mix design was not fully added at the plant, then that amount of water may be added under the direct supervision of the Owner's testing agency representative.
- B. Place concrete in accordance with ACI 304R.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement and embedded parts will not be disturbed during concrete placement.
- E. 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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or derbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Do not interrupt successive placement; do not permit cold joints to occur.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 CONCRETE FINISHING

- A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, and thin set ceramic tile.
 2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- B. Apply hardener to scheduled floor surfaces in accordance with manufacturer's instructions. See Section 03 35 11.

3.06 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 1. Normal concrete: Not less than seven days.
 2. High early strength concrete: Not less than four days.
- C. Surfaces Not in Contact with Forms:
 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 2. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - 1) Water.
 - 2) Continuous water-fog spray.
 - 3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.
 - b. 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. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 1) Use moisture-retaining covers to cure concrete surfaces to receive floor coverings and penetrating liquid floor treatments

3.07 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.08 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface treatments for concrete floors and slabs.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of experience.
- B. Flooring supplier shall approve concrete mix additives, topical treatments and curing methods prior to concrete placement.

1.06 MOCK-UP

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.
- B. Comply with manufacturer's written storage instructions.
- C. Comply with manufacturer's written handling instructions prior to mixing.

1.08 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

- A. Liquid Densifier and Hardener:
 - 1. Use at following locations: all areas of exposed concrete, including those indicated as sealed concrete "SC".

2.02 DENSIFIERS AND HARDENERS

- A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.

1. Composition: silicate and siliconate polymers.
2. Products:
 - a. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - b. Concrete Sealers USA; PS103 or PS107: www.concretesealersusa.com.
 - c. CureCrete; Ashford Formula; www.ashfordformula.com
 - d. Dayton Superior Corporation; Sure Hard Densifier J17: www.daytonsuperior.com.
 - e. Euclid Chemical Company; EucoDiamond Hard; www.euclidchemical.com
 - f. Kaufman Products Inc; SureHard LS: www.kaufmanproducts.net/#sle.
 - g. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; SEAL HARD: www.lmcc.com/#sle.
 - h. L.M. Scofield Company; SCOFIELD Formula One Lithium Densifier MP: www.scofield.com.
 - i. Nox-Crete Inc; Duro-Nox LS: www.nox-crete.com/#sle.
 - j. PROSOCO, Inc; Consolideck LS/CS: www.prosoco.com/consolideck/#sle.
 - k. SpecChem, LLC; SpecHard: www.specchemllc.com/#sle.
 - l. W. R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com/#sle.
 - m. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
- C. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
 1. If water droplets applied to surface do not soak in within 30 seconds, additional preparation is required. Chemically etch surface prior to proceeding with coating application.

3.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

- A. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- B. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

SECTION 04 01 10
MASONRY CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cleaning of existing masonry surfaces, including:
 - 1. Brick.
 - 2. Concrete unit masonry
 - 3. Limestone or Sandstone
- B. The intent is to remove soil and biological growth, with a comprehensive cleaning program consisting of focused cleaning to remove paint or other foreign material from masonry, and a light overall cleaning after repointing, repair and other work associated with this project is complete.

1.02 RELATED REQUIREMENTS

- A. Section 04 01 20 - Maintenance of Masonry; additional masonry restoration requirements

1.03 DEFINITIONS

- A. Very Low-Pressure Spray: Under 100 psi (690 kPa); 50 psi typically
- B. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)
- C. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)
- D. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)
- E. Biological Growth: Algaic and other growths on masonry surfaces – most prevalent on the limestone under projecting belt courses.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Conference: Conduct conference at Project site, exact location to be determined and approved by owner.
 - 1. Review methods and procedures related to cleaning masonry including, but not limited to, the following:
 - a. Verify masonry-cleaning equipment and facilities needed to make progress and avoid delays.
 - b. Materials, material application, and sequencing.
 - c. Cleaning program.
 - d. Coordination with building occupants.

1.05 SUBMITTALS

- A. See General Conditions and Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include material descriptions and application instructions.
 - 2. Include test data substantiating that products comply with requirements.
- C. Qualification Data: For paint-remover manufacturer and chemical-cleaner manufacturer.
- D. Preconstruction Test Reports: For cleaning materials and methods.
- E. Cleaning Program: Written description indicating cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials on building and on project site; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage.
 - 1. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.06 QUALITY ASSURANCE

- A. Restoration Specialist: Engage an experienced masonry restoration and cleaning firm that has completed work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
 - 1. At Contractor's option, the work may be divided between 2 specialist firms: 1 for cleaning work and 1 for repair work.
- B. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- C. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- D. Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Little possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave a residue on surfaces.
- E. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 50 feet away by Architect.
 - 1. Perform additional paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.

1.07 MOCK-UP

- A. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) for each type of masonry and surface condition.
 - a. Required at brick and stone only.
 - b. Prepare side-by-side mock-ups of several specified products.
 - c. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
 - d. Repeat, using different cleaning methods for up to three different panels.
 - e. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - 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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - 4. Receive owner approval before proceeding with remainder of work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store restoration cleaner and other materials in manufacturer's packaging.

1.09 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry-cleaning work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Clean masonry surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least seven days after completion of cleaning.
- C. Environmental Requirements/Conditions: Ensure that all treatments comply with institutional, local, state and federal regulations. Apply, contain and dispose of all treatments in accordance with applicable institutional, local, state and federal regulations.

1.10 COORDINATION

- A. Coordinate stone restoration and cleaning with public circulation patterns at Project site. Plan and execute the Work accordingly.

1.11 SEQUENCING AND SCHEDULING

- A. Order cleaning materials at earliest possible date to avoid delaying completion of the Work.
- B. Perform masonry restoration work in the following sequence:
 - 1. Perform cleaning according to Section 04 01 10 - Masonry Cleaning.
 - a. Remove plant growth if present.
 - b. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - c. Remove paint, sealant and other foreign materials.
 - d. Clean masonry surfaces.
 - 2. Where water repellents, specified in Section 07 19 00 - Water Repellents, are to be used on or near masonry work, delay application of these chemicals until after pointing and final cleaning.
 - 3. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 - 4. Repair masonry, including replacing existing masonry with new masonry materials.
 - 5. Rake out mortar from joints to be repointed.
 - 6. Point mortar and sealant joints.
 - 7. As scaffolding is removed, patch anchor holes used to attach scaffolding.
 - 8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. American Building Restoration Products Inc.
- B. Cathedral Stone Products, Inc.
- C. Diedrich Technologies, Inc.
- D. Dumond Chemicals, Inc.
- E. EaCo Chem, Inc.
- F. Hydroclean; Hydrochemical Techniques, Inc.
- G. PROSOCO, Inc.
- H. Shore Corporation
- I. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation, for removing paint and sealants from masonry; containing no methylene chloride.

- B. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation, for removing asphalt and tar from masonry.
- C. Granite Coating Stripper: Alkaline formula with organic solvents - removes multiple layers of paint and graffiti from masonry surfaces. Provide with manufacturer's recommended neutralizer.
 - 1. Product: Prosoco Sure Klean "Heavy Duty Paint Stripper" with "Limestone and Masonry Afterwash" or approved equal.

2.03 CLEANING MATERIALS

- A. General: Provide environmentally-friendly product that does not require neutralization. Other cleaners may be proposed based on prior experience, for review by Design Professional.
- B. Water: Potable.
- C. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
- D. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
- E. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
- F. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 - 1. Application: polished stonework (marble, granite) or glazed masonry
 - 2. Products: Subject to compliance with requirements, provide the following:
 - a. PROSOCO; Standoff Liquid Marble Cleaner
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Stain Remover: Non-acidic poultice equal to Prosoco "Marble Poultice".
- H. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
 - 1. Products:
 - a. Diedrich Technologies Inc.; Diedrich 910PM Polished Marble Cleaner
 - b. Price Research, Ltd.; Price Non-Acid Masonry Cleaner
 - c. PROSOCO; Enviro Klean 2010 All Surface Cleaner.
- I. Citrus Cleaner: Water-based, 100% biodegradable non-acidic cleaner for masonry surfaces.
 - 1. Products: Subject to compliance with requirements, provide the following or a comparable product:
 - a. ChemMasters: 1201 Citrus Cleaner Degreaser.
 - b. Hydroclean: HT-55 Citrus Cleaner and Degreaser.
- J. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
 - 1. Application: dissolving mortar smears and construction dirt, and removal of efflorescence.
 - a. Can be used on brick, tile and concrete surfaces
 - b. DO NOT use on limestone or polished stone.
 - 2. Products: Subject to compliance with requirements, provide the following:
 - a. PROSOCO; Sure Klean 600
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- K. One-Part Limestone Acidic Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. ABR Products, Inc.; X-190 Limestone & Concrete Cleaner

- b. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean Limestone and Marble Cleaner and Brightener (HT-907)
 - c. Price Research, Ltd.; Price Limestone Restorer
 - d. PROSOCO; Sure Klean Limestone Restorer
- L. One-Part Heavy Duty Acidic Cleaner: Manufacturer's standard one-part acidic formulation for cleaning unpolished masonry.
 - 1. Application: removal of atmospheric dirt and black carbon stains from unpolished masonry.
 - a. Dilute with water to produce a cost-effective, general-purpose restoration cleaner for brick, granite, sandstone, slate, terra cotta and many other masonry surfaces.
 - b. DO NOT use full-strength on concrete or limestone.
 - 2. Products: Subject to compliance with requirements, provide the following:
 - a. PROSOCO; Sure Klean Heavy Duty Restoration Cleaner

2.04 ACCESSORY MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABR Products, Inc.; Rubber Mask.
 - b. Price Research, Ltd.; Price Mask.
 - c. PROSOCO; Sure Klean Strippable Masking.

2.05 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

PART 3 EXECUTION

3.01 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
- B. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not apply chemical solutions during winds of enough force to spread them to unprotected surfaces.
 - 4. Neutralize alkaline and acid wastes before disposal.
 - 5. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.02 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 50 feet (15m) away by Architect.
- B. Proceed with cleaning in an orderly manner; work from bottom to top of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.
- C. Use only those cleaning methods indicated for each masonry material and location.
 - 1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
 - a. Equip units with pressure gages.
 - 3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - 4. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - 5. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
 - 6. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
- D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.
- E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.
- F. Water Application Methods:
 - 1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 - 2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- G. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi (345 kPa). Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - 1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- I. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.03 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.
- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, sealants, asphalt, and tar.
 - 1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
 - 2. Remove paint and sealants with alkaline paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Repeat application up to two times if needed.
 - 3. Remove asphalt and tar with solvent-type paste paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Apply paint remover only to asphalt and tar by brush without prewetting.
 - c. Allow paint remover to remain on surface for 10 to 30 minutes.
 - d. Repeat application if needed.

3.04 PAINT REMOVAL

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- B. Paint Removal with Alkaline Paste Paint Remover:
 - 1. Remove loose and peeling paint using medium-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply paint remover to dry, painted surface with brushes.
 - 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 4. Rinse with cold water applied by medium-pressure spray to remove chemicals and paint residue.
 - 5. Repeat process if necessary to remove all paint.
 - 6. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
 - 7. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
- C. Paint Removal with Solvent-Type Paste Paint Remover:
 - 1. Remove loose and peeling paint using medium-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats according to manufacturer's written instructions.
 - 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.

3.05 CLEANING MASONRY

- A. Cold-Water Soak:
 - 1. Apply cold water by intermittent spraying to keep surface moist.
 - 2. Use perforated hoses or other means that apply a fine water mist to entire surface being cleaned.

3. Apply water in cycles of five minutes on and 20 minutes off.
 4. Continue spraying until surface encrustation has softened enough to permit its removal by water wash, as indicated by cleaning tests.
 5. Remove soil and softened surface encrustation from surface with cold water applied by low-pressure spray.
- B. Cold-Water Wash: Use cold water applied by high-pressure spray.
- C. Hot-Water Wash: Use hot water applied by high-pressure spray.
- D. Detergent Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
 3. Rinse with cold water applied by medium-pressure spray to remove detergent solution and soil.
 4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
- E. Mold, Mildew, and Algae Removal:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
 4. Rinse with cold water applied by medium-pressure spray to remove mold, mildew, and algae remover and soil.
 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
- F. Nonacidic Gel Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 4. Remove bulk of gel cleaner.
 5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- G. Nonacidic Liquid Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 4. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- H. Citrus Chemical Cleaning
1. Wet masonry with cold water applied by low-pressure spray.

2. Apply cleaner according to manufacturer's written instructions and as established by mockup.
 3. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil. Water pressure not to exceed 600 psi.
 4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- I. Mild-Acid Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer and as established by mockup.
 4. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- J. Acidic Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply cleaner to surface in one applications by brush or low-pressure spray.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer and as established by mockup.
 4. Gently scrub heavily soiled areas.
 5. Do not let cleaner dry on the surface. If drying occurs, lightly wet treated surfaces with fresh water and reapply in a gentle scrubbing manner.
 6. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
 7. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- K. One-Part Limestone Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply cleaner to surface by brush or low-pressure spray.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
 5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.

3.06 FIELD QUALITY CONTROL

- A. Architect's Project Representatives: Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.

3.07 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent non-masonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.
- C. Remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

D. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION

SECTION 04 01 20
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procurement of a Masonry Analysis Report
- B. Procurement of a Mortar Analysis Report
- C. Removal and Repointing of mortar joints with:
 - 1. Setting and Pointing Mortar
 - 2. Sealant, for movement joints.
- D. Repair of damaged masonry, including patching compound and dutchman repairs for:
 - 1. Brick
 - 2. Limestone
- E. Painting steel uncovered during the work.
- F. Thru-wall / embedded flashings and accessories.
- G. Miscellaneous work in order to provide a water-tight envelope.

1.02 RELATED REQUIREMENTS

- A. Section 02 41 00 - Demolition.
- B. Section 04 01 10 - Masonry Cleaning; Paint removal and cleaning of exposed unit masonry and stone surfaces.
- C. Section 04 20 00 - Unit Masonry: Block masonry units.
- D. Section 07 62 00 - Sheet Metal Flashing and Trim; flashing and counterflashings
- E. Section 09 96 00 - High Performance Coating: paint for steel exposed during masonry removal indicated to receive "HPC"

1.03 REFERENCE STANDARDS

- A. ASTM C 67, Standard Methods of Sampling and Testing Brick and Structural Clay Tile; 2009.
- B. ASTM C 91 - Standard Specification for Masonry Cement; 2005.
- C. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar; 2004.
- D. ASTM C 150 - Standard Specification for Portland Cement; 2005.
- E. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.
- F. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2007.
- G. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 DEFINITIONS

- A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- B. Medium-Pressure Spray: 400 to 800 psi (2750 to 5500 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
- C. Stone Terminology: ASTM C 119.
- D. Refacing: Remove defective portion of the face of the existing stone back to sound stone.
- E. Stone Patching Compound: The removal of severely deteriorated original stone and replacement with a composite mix that has been formulated to closely match the color, texture, consistency and other physical properties of the surrounding stone.
- F. Face Bedding: Setting of stone with the natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.

- G. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- H. Saturation Coefficient (C/B ratio): Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
 - 1. Require attendance of parties directly affecting work of this section.
 - 2. Confirm Masonry Analysis Report and Mortar Analysis Report are complete and available for discussion.
 - 3. Review conditions of installation, installation procedures, and coordination with related work.
 - 4. Review Construction Schedule: Verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - 5. Review materials, material application, sequencing, tolerances, and required clearances.

1.06 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: The Contractor is to engage a qualified testing agency to perform preconstruction testing on masonry units as follows.
 - 1. Provide test specimens as indicated and representative of proposed materials and construction. Copy Architect and Owner on results.
 - 2. Existing Masonry: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption. Carefully remove five existing units from locations designated by Architect. Take testing samples from these units.
 - 3. Existing Mortar: Test according to ASTM C 1324, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Carefully remove existing mortar from within joints at five locations designated by Architect or testing service.
 - 4. Temporary Patch: As directed by Architect, provide temporary materials at locations from which samples were taken.
 - 5. Replacement Masonry: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption.

1.07 SUBMITTALS

- A. See General Conditions and Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate setting details of stone, details of special masonry shapes, special supports for the work, and provisions for expansion joints, sealant joints, flashing, lighting fixtures, conduits, and weep holes as required. Detail temporary or permanent support.
 - 1. Include plans, elevations, sections, and locations of repointing work on the structure.
 - 2. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.
- C. Product Data: Provide data on patching materials and mortar.
 - 1. Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- D. Testing Sample: Provide cured mortar sample for testing. Transmit sample directly to testing agency for Mortar Analysis. Copy Architect and Owner on results.

- E. Samples for Initial Selection:
 - 1. Sealant Materials: See Section 07 92 00 - Joint Sealants for products.
 - 2. Accessories involving color selection.
- F. Samples for verification:
 - 1. Each type of masonry unit to be used for replacing existing units. Include sets of Samples as necessary to show the full range of shape, color, and texture to be expected.
 - a. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
 - b. For stone, provide sets at least two 4-by-12-inch samples for each type, but no fewer than necessary to indicate full range and the proportion of variations within range.
 - 2. Each type, color, and texture of setting and pointing mortar in the form of sample mortar strips, 6 inches (150 mm) long by 1/2 inch (13 mm) wide, set in aluminum or plastic channels.
 - a. Provide mortar determined to be compatible with mortar test as established by NPS standards for preservation.
 - b. Have each set contain a close color range of at least three samples of different mixes of colored sands and cements that produce a mortar matching the cleaned masonry when cured and dry.
 - c. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each sample was made.
 - 3. Patching Compound: Submit sets of patching compound samples in the form of plugs in sample units of stone representative of the range of stone colors on the building.
 - a. Have each set contain a close color range of at least three Samples of different mixes of patching compound that matches the variations in existing stone when cured and dry.
 - 4. Accessories: Each type of anchor, accessory, and miscellaneous support.
- G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- H. Restoration program for each phase of the restoration process, including protection of surrounding materials on the building and Project site during operations.
 - 1. Describe in detail the locations, materials, methods, equipment, and sequence of operations to be used for each phase of the restoration work. Documentation shall include:
 - a. Existing general masonry failures that contribute mortar losses shall be noted and should be scheduled for repair prior to repointing.
 - b. Analysis of mortar type and color shall be conducted, the extent and type of analysis to be determined by the Architect.
 - c. 'Before' photo documentation of areas to be worked.
 - 2. If alternative materials and methods to those indicated are proposed for any phase of restoration work, provide a written description, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.08 QUALITY ASSURANCE

- A. Intent of this section is to return the envelope to a water tight condition while maintaining the original aesthetics.
- B. Restoration Specialist: Engage an experienced masonry restoration and cleaning firm that has completed work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
 - 1. At Contractor's option, the work may be divided between 2 specialist firms: 1 for cleaning work and 1 for repair work.

2. Field Supervision: Require restoration specialist firms to maintain an experienced full-time supervisor on the Project site during times that masonry restoration and cleaning are in progress.
 3. Contractors, subcontractors and craftsmen will be required to have the skill to remove existing materials without damage to the material itself and its substrate. They will be required to have the skill to reinstall historic materials without damage to other historic material without damage to other historic material. All organizations and individuals must have had the experience with restoration work as specified or with work requiring equivalent skill.
- C. Masonry and mortar used on historic building components are to match Masonry and Mortar Analysis, using constituent materials as close as possible using available materials.
1. Laboratory analysis shall be undertaken at cost of Contractor to match new binder components and proportions with historic mortar.
- D. Select materials and methods of use based on the following, subject to approval of a mockup:
1. Previous effectiveness in performing the work involved.
 2. Little possibility of damaging exposed surfaces.
 3. Consistency of each application.
 4. Uniformity of the resulting overall appearance.
 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave a residue on surfaces.
- E. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 50 feet away by Architect.

1.09 MOCK-UP

- A. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 6 adjacent whole units or approximately 48 inches in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
1. Replacement: Four units of each type replaced.
 2. Partial Replacement: Two partial replacements (dutchman repairs).
 3. Reanchoring Veneers: Install three masonry repair anchors in mockup wall assembly of each anchor type required.
 4. Stone Plug Repair: Two plug repairs for each type of stone indicated to be plugged.
 5. Crack Injection: Apply crack injection in two separate areas, each approximately 36 inches (900 mm) long].
 6. Patching: Three small holes at least 1 inch in diameter for each type of masonry material indicated to be patched, so as to leave no evidence of repair.
- B. Restore and repoint an existing masonry wall area sized 4 feet long by 4 feet high; include in mock-up area instances of mortar, accessories, wall openings, and flashings.
1. Rake out joints in 2 separate areas for each type of repointing required and repoint one of the areas.
 2. Mock-ups will be reviewed after the mortar removal and again after completion of repointing.
 3. Test panels will be inspected for color, texture, and installation technique.
- C. Locate where directed.
- D. Acceptable panel and procedures employed will become the standard for work of this section.
1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- E. If the first mock ups are unacceptable, the Contractor shall prepare up to three additional mock-ups of each mortar, joint type, and mortar color without further compensation.
- F. Approved mock-ups may remain as part of the Work, if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.
- B. Store other materials in manufacturer's packaging.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store lime putty covered with water in sealed containers.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.11 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
- C. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

1.12 COORDINATION

- A. Coordinate masonry restoration and cleaning with public circulation patterns at Project site. Plan and execute the Work accordingly.
- B. Coordinate schedule with roof replacement work.

1.13 SEQUENCING AND SCHEDULING

- A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.
- B. Order sand and portland cement for pointing mortar immediately after approval of samples and mockups. Take delivery of and store at Project site a sufficient quantity to complete Project.
- C. Perform masonry restoration work in the following sequence:
 1. Perform cleaning according to Section 04 01 10 - Masonry Cleaning.
 - a. Remove plant growth if present.
 - b. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - c. Remove paint, sealant and other foreign materials.
 - d. Clean masonry surfaces.
 2. Where water repellents, specified in Section 07 19 00 - Water Repellents, are to be used on or near masonry work, delay application of these chemicals until after pointing and final cleaning.
 3. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 4. Repair masonry, including replacing existing masonry with new masonry materials.
 5. Rake out mortar from joints to be repointed.

6. Point mortar and sealant joints.
7. As scaffolding is removed, patch anchor holes used to attach scaffolding.
8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Restoration Materials:
 1. ABR (American Building Restoration) Products, Inc.
 2. Cathedral Stone Products, Inc.
 3. Diedrich Technologies, Inc: www.diedrichtechnologies.com.
 4. Dumond Chemicals, Inc.
 5. HMK Stone Care System: www.hmkstonecare.com.
 6. PROSOCO: www.prosoco.com.
 7. Price Research, Ltd..
 8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MORTAR MATERIALS

- A. General: Provide mortar materials to match existing.
- B. Portland Cement: ASTM C 150, Type I or Type II, white, gray or both where required for color matching of exposed mortar, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- C. Hydrated Lime: not allowed
- D. Lime Putty: Conform to ASTM C 5.
- E. Sand: Match existing mortar particle shape, gradation and void ratios; free of impurities, such as salts or clay. ASTM C 144 unless otherwise indicated.
 1. Color: Provide natural sand of color necessary to match existing.
 2. For pointing mortar, provide sand with rounded edges.
 3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, or incorporate ground stone, if necessary to achieve suitable match to existing.
- F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
 1. Custom mix to match existing masonry
- G. Water: Clean, potable, and not detrimental; free from acids, alkalis, or other dissolved organic materials.
- H. Other Components: Match all other historic components in accordance with laboratory analysis.

2.03 MASONRY MATERIALS

- A. General: Decorative elements with greater than 2" sq of damage will need to be repaired. If more than 25% of the stone block is missing the entire block will need to be replaced.
- B. Brick: Patch brick to the extent possible. Replacement of brick is not anticipated
- C. Limestone: Patch limestone to the extent possible. Replacement of stone is not anticipated.
- D. Block: Section 04 20 00.

2.04 REPAIR MATERIALS

- A. Clay Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching clay masonry.
 1. Use formulation that is vapor and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than masonry units being repaired, and develops high bond strength to all types of masonry.

2. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 3. Formulate patching compound in colors and textures to match each masonry unit being patched. Provide sufficient number of colors to enable matching of the color, texture, and variation of each unit.
 4. Manufacturers:
 - a. Cathedral Stone Products, Inc.;
 - b. Conproco Corporation;
 - c. Edison Coatings, Inc.;
 - d. Jahn Restoration Mortars;
- B. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone; mineral based, 1-component, non-shrinking mortar, colored to match existing limestone elements; moisture, frost and salt resistant.
1. Use formulation that is vapor- and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all types of stone.
 2. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide not less than three colors to enable matching each piece of stone.
 3. Manufacturers:
 - a. Cathedral Stone Products, Inc.;
 - 1) Limestone: Jahn Restoration Mortars "Limestone M70 Series" or approved equal
 - b. Conproco Corporation; Mimic.
 - c. Edison Coatings, Inc.; Custom System 45
 - d. Jahn Restoration Mortars; S70 Natural Stone Repair Mortar
- C. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Cathedral Stone Products, Inc.; Jahn Injection Grout
 - b. Conproco Corporation; Stone or TerraCotta Finish
 - c. Edison Coatings, Inc.; Pump-X 53-Series
- D. Stone-to-Stone Adhesive: Two-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F (21 deg C), or 1-part cementitious stone adhesive, recommended in writing by adhesive manufacturer for type of stone repair indicated, and matching stone color.
1. Two-Part Polyester or Epoxy-Resin Stone Adhesive Products: Subject to compliance with requirements, provide the following:
 - a. Akemi North America;
 - b. Bonstone Materials Corporation; Fast Set 41.
 - c. Edison Coatings, Inc.; Flexi-Weld 520T
 2. One-Part Cementitious Stone Adhesive:
 - a. Cathedral Stone Products, Inc.; Jahn Restoration Adhesive
- E. Stone Consolidation Treatment: Ready-to-use product designed for consolidation of stone that has deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, and solvents.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Akemi North America; Stone Strengthener K
 - b. Cohalan Company, Inc.; Keim Silex OH
 - c. Diedrich Technologies Inc.; D50C
 - d. Edison Coatings, Inc.; System 95W
 - e. PROSOCO; Conservare OH100 Stone Strengthener with HCT pretreatment.

2.05 ACCESSORIES

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Joint Sealants:
 - 1. Sealants: Ultra-low-modulus sealant and closed cell backer rod.
 - a. Product: Dow Corning 790 Silicone Building Sealant or approved equal.
 - b. Colors: Provide colors of exposed sealants to match colors of masonry adjoining installed sealant unless otherwise indicated.
 - c. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints, for broadcasting into sealant. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the No. 100 sieve.
 - 2. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where acceptable.
- D. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- E. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. ABR Products, Inc.; Rubber Mask.
 - b. Price Research, Ltd.; Price Mask.
 - c. PROSOCO; Sure Klean Strippable Masking.
- F. Anchor Setting Mortar:
 - 1. Product: Cathedral Stone Products - Jahn Anchor Setting Mortar "M80 Series" or approved equal.
- G. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch- diameter, Type 304 stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Dur-O-Wal, a division of Dayton Superior; Dur-O-Wal Repair Anchor.
 - b. Hohmann & Barnard, Inc.; #521RA-B Restoration Anchor.
- H. Masonry Repair Anchors, Spiral Type: Type 304 stainless-steel spiral rods designed to anchor to backing and veneer. Anchors are flexible in plane of veneer but rigid perpendicular to it.
 - 1. Provide adhesive-installed anchors complete with manufacturer's standard epoxy adhesive and injection tubes, or other devices required for installation.
 - 2. Provide driven-in anchors designed to be installed in drilled holes and relying on screw effect rather than adhesive to secure them to backup and veneer.
 - 3. Products: Subject to compliance with requirements, provide the following:
 - a. Dur-O-Wal, a division of Dayton Superior; Dur-O-Flex Friction Pin Anchor.
 - b. Heckmann Building Products Inc.; #391 Remedial Tie.
 - c. Hohmann & Barnard, Inc.; Helix Spiro-Ties.

- I. Stone Anchors and Pins: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and pins from Type 304 stainless steel.
- J. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.
- K. Epoxy adhesive (for embedding anchors and pins): high modulus epoxy resin conforming to ASTM C-881, Type I, II, IV and V, Grade 3 epoxy resin adhesives
- L. Non-shrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout. The Contractor shall provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this procedure or an Architect approved equivalent.
- M. Corrosion Resistant Primer and Bonding Agent: two-component, latex-cement primer and bonding agent designed to protect steel reinforcement from corrosion while promoting adhesion between patching compounds and concrete and steel substrates; odorless, non-flammable, waterborne system.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Edison Coatings, Inc.; System 49 CPBA
- N. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
 - 1. See Section 09 21 13 and 09 21 23 - Painting for additional requirements.
 - 2. Use coating requiring no better than SSPC-SP 3, "Power Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.
- O. Stainless Steel/Polymer Fabric Flashing: ASTM 167 Type 304, 0.003-inch, stainless steel sheet bonded with rubber-based adhesive to one sheet of polymer fabric.
 - 1. Puncture Resistance: 2,500 psi per ASTM E154.
 - 2. Manufacturers:
 - a. York Manufacturing, Inc; "Multi-Flash SS": www.yorkmfg.com.
 - b. Hohmann and Barnard; "Mighty Flash"; www.h-b.com.
- P. Drip Edges: Minimum 26 gauge stainless steel with hemmed edge and formed at 45-degrees. Provide with factory-installed foam seal on bottom.
 - 1. Manufacturers:
 - a. York Manufacturing, Inc; www.yorkmfg.com.
 - b. Hohmann and Barnard; "DP-FTS"; www.h-b.com.
- Q. Limestone Elastomeric Coating: Water-based silicone elastomer for waterproofing above-grade exterior masonry substrates.
 - 1. Application: top of limestone balustrade over adjacent flashings.
 - 2. Perms: 40 minimum, tested per ASTM D1653
 - 3. Product: Dow Corning: AllGuard Silicone Elastomeric Coating or approved equal.
- R. Weeps: Cotton rope
- S. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Minimal possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could leave residue on surfaces.

2.06 MORTAR MIXES

- A. Mortar for Existing Masonry Veneer: ASTM C 270, using the Proportion Specification.
 - 1. Exterior, Non-Loadbearing Masonry: Type shall be custom mixed to match existing and conform to following:

- a. New mortar, when cured, shall match historic mortar in color, texture and tooling.
 - b. New mortar shall have greater vapor permeability and be softer (measured in compressive strength) than existing masonry.
 - c. New mortar shall be as vapor permeable and as soft or softer (measured in compressive strength) than the historic mortar.
- 2. Mortar Proportions: Pointing specialist shall determine mortar mix proportions for the brick masonry, in conjunction with Mortar Analysis results.
 - a. Type O
 - b. Type K may be required
- B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- C. Colored Mortar: Produce mortar of color and aggregate required by using specified ingredients. Do not alter specified proportions without Architect's approval.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.
- D. Do not use admixtures in mortar unless otherwise indicated.

2.07 EQUIPMENT FOR RAKING AND REPOINTING

- A. Equipment for raking joints:
 - 1. Hand chisels and mash hammers
 - 2. Power tools including small pneumatically-powered chisels, scaler (power chipper), and thin diamond-bladed grinders. Power saws are not generally recommended.

PART 3 EXECUTION

3.01 GENERAL

- A. Repairs and restoration shall use techniques, methods, and materials as similar as possible to those of the original. Work should be sequenced not only to assure the stability of the structure and protection of personnel during the work, but also to address a sensible order of construction to integrate new work with existing work.
- B. Results of the masonry and mortar analysis shall have been completed. Work shall not proceed until the test results have been submitted and reviewed.
- C. The Contractor shall have completed and submitted the restoration program for the proposed work, to address the condition of the mortar and masonry, and the proposed methods and materials to be used.
- D. Follow manufacturer's instructions for mixing and installation of proprietary materials and equipment.
- E. Complete façade cleaning prior to beginning masonry repair or restoration work.
- F. Stabilize deteriorated and loose units that are not scheduled to be removed or that cannot be easily removed. Areas where units are missing or have been removed should be protected against moisture penetration until replacement units can be installed.

3.02 EXAMINATION

- A. Verify that surfaces to be restored and replaced are ready for work of this section.

- B. Prior to commencing the work, the Contractor shall complete a survey to determine the extent and severity of the deterioration and whether the deterioration involves visual aspects of the masonry, the failure of joints between units, the structural failure of the units themselves, the failure of support systems, or the overall structural stability of the building façade.
- C. Notify the Architect if the extent and severity of the deterioration is in variance with the contract documents:
- D. Existing general failures that contribute to masonry deterioration should be scheduled for repair prior to completion of the planned restoration work or in conjunction with masonry replacements.
 - 1. Missing units.
 - 2. Deteriorated or missing mortar.
 - 3. Large cracks (particularly those running through multiple units).
 - 4. Material failures such as spalls and parallel crazing.
 - 5. Presence or absence of water-shedding devices such as flashings, gutters, and downspouts.
 - 6. Bulges in the masonry, particularly at floor level and at piers.
 - 7. Rust stains from failing anchors.
 - 8. Efflorescence from excessive moisture in the wall.
 - 9. Internal damage: Strike surface with a wooden mallet to determine internal damage. Damaged units produce a flat thud, while undamaged units give off a clear ringing sound. Check for consistent tonal values to aid in the location of damaged units.

3.03 PREPARATION

- A. Protect surrounding elements from damage due to restoration procedures.
 - 1. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
- B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
- C. Separate areas to be protected from restoration areas using means adequate to prevent damage.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives
 - 2. Cover existing landscaping with tarpaulins or similar covers.
 - 3. Cover sills, ledges, and projections to protect from mortar droppings.
 - 4. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 5. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - 6. Clean mortar splatters from scaffolding at end of each day.
- D. Remove gutters and downspouts adjacent to masonry and store during masonry restoration and cleaning. Reinstall when masonry restoration and cleaning are complete.
 - 1. Provide temporary rain drainage during work to direct water away from building
- E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
- F. Close off adjacent occupied areas with dust proof and weatherproof partitions.
- G. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area and traffic route.

- H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.
 - 1. If applicable, as an alternative, keep wall wet below area being cleaned and rinse often to prevent streaking from runoff.

3.04 MASONRY REMOVAL AND REPLACEMENT, OR REBUILDING

- A. Replace units with disintegration, spalls or erosions to a depth greater than 3/16-inch.
- B. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.
 - 1. When removing single units, remove material from center of the unit and work toward outside edges.
- C. Cut in new control joints as indicated in the drawings.
- D. Support structure as necessary in advance of cutting out units.
- E. Cut away loose or unsound adjoining masonry, mortar, and sealant as directed.
- F. Protect remaining masonry that surrounds removal area.
- G. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.
- H. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- I. Remove stone anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. If an item cannot be removed without damaging surrounding stone, replace unit as directed.
 - a. Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - 3. Patch hole where each item was removed unless directed to remove and replace masonry unit.
- J. For areas indicated for salvage, remove in an undamaged condition as many whole pieces as possible.
 - 1. Carefully dismantle selected areas of masonry where designated on the Drawings. Dismantle adjacent assemblies as required for access to the designated masonry, salvaging components for reuse to the greatest extent possible.
 - 2. Remove mortar, loose particles, and soil from brick by cleaning and tools to sufficiently open pores for reinstallation.
 - 3. Rake or grind mortar from joints to the greatest extent possible before attempting removal of the units. Avoid excessive prying against the arises of the masonry units to avoid spalling and chipping
 - 4. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 - 5. Carefully cut existing metal anchors and armature to release terra-cotta units. Provide padded shoring as required to hold assembly in place once anchors are removed. Remove embedded metal parts down to the terra-cotta surface by drilling or grinding. Do not burn metal next to terra-cotta surfaces.
 - 6. Label each unit on the concealed side with non-removable marking keyed to the Drawings to ensure reinstallation of each unit in its original location.
 - 7. Store masonry for reuse. Store off ground, on skids, and protected from weather.
 - 8. Clean old mortar and sealants from units to be reassembled.

9. Stockpile salvaged masonry units in a secure location, away from general construction operations. Store units on pallets or in sturdy crates as required for protection. Stockpile in order of reinstallation to minimize unnecessary handling.
10. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- K. Build in new or reclaimed units following procedures for new work specified in other section(s).
- L. Replace damaged masonry with salvaged masonry in good quality where possible, or with new masonry matching existing masonry, including size.
 1. Do not use broken units unless they can be cut to usable size. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
- M. Partial Stone Replacement: Remove defective portion of existing stone unit. Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and demolishing defective material to depth required for fitting partial replacement (dutchman).
 1. Make edges of backing stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Make back of removal area flat and parallel to stone face.
 2. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
 3. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
 4. Cut and trim partial replacement to accurately fit area where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch (1.6 mm) in width, and to produce joints between partial replacement and other stones that match existing joints between stones. Cut partial replacement so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.
 5. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, [plain] [threaded] stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of partial replacement and into backing stone.[Center and space pins 3 to 5 inches (75 to 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into backing stone and 2 inches (50 mm) into partial replacement with end countersunk at least 3/4 inch (19 mm) from exposed face of partial replacement.]
 6. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, [plain] [threaded] stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into backing stone and into, but not through, the partial replacement.[Center and space pins 3 to 5 inches (75 to 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into backing stone and 2 inches (50 mm) into partial replacement, but no closer than 3/4 inch (19 mm) from exposed face of partial replacement.]
 7. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of backing stone and partial replacement, completely filling all crevices and voids.
 8. Apply partial replacement while adhesive is still tacky and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of backing stone.
 9. Retain option in paragraph below if retaining "Pinning" Paragraph.
 10. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.
- N. Mortar Mix: Colored and proportioned to match existing work.
- O. Ensure that anchors, ties, reinforcing, and flashings are correctly located and built in.

- P. Install built in masonry and stone work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.
 - 1. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing.
 - 2. Maintain joint width for replacement masonry to match existing joints.
 - 3. Use setting buttons or shims to set stone accurately spaced with uniform joints.
- Q. Lay replacement brick with rebuilding (setting) mortar, with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brick or stone work.
 - 2. Rake out mortar used for laying masonry before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - 3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- R. Set replacement stone with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brick or stone work.
 - 2. Rake out mortar used for laying masonry before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - 3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- S. Do not allow face bedding of masonry. Before setting, inspect to verify that each piece has been cut so that, when it is set in final position, natural bedding planes are essentially horizontal.
- T. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - 1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.05 STONE FRAGMENT REPAIR (OR INFILL):

- A. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.
- B. Prepare stone fragment to be placed in infill location.
- C. Remove soil, loose particles, mortar, and other debris or foreign material, from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.
- D. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into parent stone and into, but not through, the fragment. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into parent stone and 2 inches (50 mm) into fragment, but no closer than 3/4 inch (19 mm) from exposed face of fragment.
- E. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.

- F. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.
- G. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in Masonry Unit Patching below.

3.06 CRACK INJECTION

- A. General: Comply with cementitious crack-filler manufacturer's written instructions.
- B. Drill 1/4-inch- (6-mm-) diameter injection holes as follows:
 - 1. Transverse Cracks Less Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 12 to 18 inches (300 to 500 mm) o.c.
 - 2. Transverse Cracks More Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 18 to 36 inches (500 to 900 mm) o.c.
 - 3. Delaminations: Drill holes at approximately 18 inches (500 mm) o.c. both vertically and horizontally.
 - 4. Drill holes 2 inches (50 mm) deep.
- C. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.
- D. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.
- E. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.
- F. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.
- G. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

3.07 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Inspect steel exposed during masonry removal. Where Architect determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 - 1. Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning, as applicable to meet paint manufacturer's recommended preparation.
 - 2. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application.
- B. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch, notify Architect before proceeding.

3.08 MASONRY UNIT PATCHING

- A. Patch the following masonry unless another type of replacement or repair is indicated:
 - 1. Units indicated to be patched.
 - 2. Units with holes.
 - 3. Units with chipped edges or corners.
 - 4. Units with small areas of deep deterioration.
- B. Replace units with disintegration, spalls or erosions to a depth greater than 3/16-inch.
- C. Remove and replace existing patches unless otherwise indicated or approved by Architect.
- D. Patching Brick and Stone:

1. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
8. Keep each layer damp for 72 hours or until patching compound has set.
9. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.09 REPOINTING

- A. Perform repointing prior to cleaning masonry surfaces.
- B. Joint Removal:
 1. Rake out and repoint the following:
 - a. Joints in areas indicated.
 - b. Joints where mortar is missing or where they contain holes.
 - c. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
 - d. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
 - e. Joints where they sound hollow when tapped by metal object.
 - f. Joints where they are worn back 1/4 inch or more from surface.
 - g. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
 - h. Joints where they have been filled with substances other than mortar.
 - i. Joints indicated as sealant-filled joints.
 2. Do not rake out and repoint joints where not required.
 3. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - a. Remove mortar from joints to depth of 2-1/2 times joint width, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
 - b. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - c. Do not spall or damage edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Design Professional.
 4. Use power tools only after test cuts determine no damage to masonry units will result.
 5. Do not damage masonry units.
 6. When cutting is complete, remove dust and loose material by brushing or air jet (compressed air 40-60 psi).
- C. Pointing with Mortar:
 1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.

2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 4. When mortar is thumbprint hard, tool joints concave, or to match original appearance of joints, as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
 - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
 7. Moist cure for 72 hours, and allow mortar to harden at least 30 days before beginning final cleaning work or exposure to other repairs.
- D. Pointing with Sealant:
1. Application: movement areas and vertical joints at terra cotta.
 2. After raking out, keep joints dry and free of mortar and debris.
 3. Clean and prepare joint surfaces according to Section 079200 - Joint Sealants. Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
 4. Fill sealant joints with specified joint sealant according to Section 079200 - Joint Sealants and the following:
 - a. Install cylindrical sealant backing beneath the sealant, except where space is insufficient. There, install bond-breaker tape.
 - b. Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
 - c. Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center section of the bead:
 - 1) Fill joints to a depth equal to joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.
 - d. Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - e. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
 5. Cure sealant according to Section 07 92 00 - Joint Sealants.

3.10 STONE CONSOLIDATION TREATMENT

- A. Apply treatment to clean, dry surfaces according to manufacturer's written instructions. Remove areas of blind exfoliation, delamination, and flaking before applying.
- B. Apply in cycles to small sections of stonework, not more than 100 sq. ft. in area. Each cycle shall consist of 3 successive saturating applications, applied at 5- to 15-minute intervals depending on drying conditions.
- C. Apply by low-pressure spray to point of rejection in each application. Apply from bottom of section to top.
- D. Apply 3 cycles, allowing treated surface to dry for 60 to 90 minutes between cycles.
- E. Protect treated surfaces from rain for 48 hours after treatment.
- F. Allow treated surfaces to dry for at least 21 days before repointing, patching, or applying water repellents or sealants.

3.11 CLEANING MASONRY

- A. Refer to Section 04 01 10 - Masonry Cleaning for cleaning of existing masonry, new masonry and restoration cleaning.

3.12 AGING

- A. Rub in new masonry work to match, as close as possible, adjacent original work.
- B. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.
- C. Continue process until acceptance.

3.13 FIELD QUALITY CONTROL

- A. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.

3.14 FINAL REPORT

- A. Revisit the site with the Architect after the new mortar has cured at least 30 days to compare the finish and color of the repair to see if the desired affect has been achieved.
- B. Review repairs and improvements with the Architect, including work done prevent water intrusion of main envelope or at penetrations and openings.
- C. Architect may document the work and finished product with photographs, both 'before' and 'after', and a written summary of the project and results upon final inspection and approval.
- D. Provide written recommendations for items identified in walk-through or final report and steps for remediation.

3.15 FINAL CLEANING

- A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
- B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
- C. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- D. Clean surrounding surfaces. Use detergent and soft brushes or cloths.
- E. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts

F. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Installation of Lintels.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 45 33 - Code-Required Testing and Special Inspections
- B. Section 05 50 00 - Metal Fabrications: Loose steel lintels and Fabricated steel items.
- C. Section 07 84 00 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- E. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
- F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- G. ASTM C150/C150M - Standard Specification for Portland Cement.
- H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- K. ASTM C476 - Standard Specification for Grout for Masonry.
- L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- M. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.
- N. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.
- O. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for masonry support system.

- D. Steel Reinforcement Shop Drawings: Prepare Shop Drawings showing details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement".
 - 1. Include material, grade, bar schedules, tie and/or stirrup spacing, splices, bent bar diagrams, and other arrangements and assemblies required for fabrication and placement of reinforcement for masonry work.
 - 2. Show all walls in plan and elevation.
- E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
- F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. See also Section 01 45 33 for testing and inspection requirements. Testing and inspection shall comply with the requirements of the governing edition of the IBC.
- C. Fire Rated Assemblies: Conform to applicable code for UL (FRD) Assembly No. listed on wall types.
- D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- E. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- F. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- G. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos.
- C. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.07 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 UNIT MASONRY - GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 - 2. Special Shapes: Provide non-standard blocks configured for corners and other detailed conditions.
 - a. Bull-nose units at exposed outside corners are not required.
 - b. Provide finished edge blocks at exposed outside corners or end walls.
 - 3. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Normal weight.

2.03 MORTAR AND GROUT MATERIALS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
 - 1. Not more than 0.60 percent alkali.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Color: as selected from manufacturer's standard range for burnished block, standard grey at others.
 - 2. Manufacturers:
 - a. Amerimix, an Oldcastle brand; AMX 405C: www.amerimix.com/#sle.
 - b. Cemex; USA; Masonry Mortar; www.cemexusa.com.
 - c. SpecMix; Portland, Lime and Sand Mortar; www.specmix.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B.
 - 2. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

- D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.

2.05 MISCELLANEOUS ANCHORS

- A. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Structural Applications:
 - a. As indicated.
 - 2. Non-Structural Applications:
 - a. Acceptable Manufacturers and products:
 - 1) Hilti Fastening Systems
 - (a) Kwik Bolt III Expansion Anchor
 - (b) HIT HY 70
 - 2) ITW Red Head:
 - (a) Trubolt Wedge Anchor
 - (b) Epcon C6 Adhesive.
 - 3) Powers Fastening Inc:
 - (a) Power-Stud Expansion Anchor
 - (b) PE1000+ Adhesive.
 - 4) Or approved equivalent.
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Joint Filler: Closed cell polypropylene; oversized 50 percent to joint width; self expanding; 3/8 inch wide by maximum lengths available.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 LINTELS

- A. Steel Lintels: See Section 05 50 00 - Metal Fabrications and Structural Drawings.

2.08 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Interior, loadbearing masonry: Type N.
 - 2. Interior, non-loadbearing masonry: Type N.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
 - 1. Minimum compressive strength: 2000 psi.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
 - a. Flush where concealed or receiving resilient base.

3.05 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.
- F. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.
- G. See Grouting Article for vertical reinforcement.

3.07 LINTELS

- A. Install loose steel lintels over openings. See Structural Notes and drawings for lintel sizing.

- B. Maintain minimum 8 inch bearing on each side of opening.

3.08 GROUTED COMPONENTS

- A. Reinforce masonry unit cores and cavities with reinforcing bars and grout as shown on structural drawings. Grout all cores containing rebar and as indicated on drawings.
 - 1. For non-structural walls shown on architectural drawings, use #5 vertical bars at 32 inches on center in fully grouted cores.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. Grouting: Do not place grout until entire pour height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for grout mix design, cleanouts, and for grout placement, including minimum grout space and maximum pour height. Cleanouts are required at the base of every vertical cell containing reinforcement where the grout pour height exceeds 12.67 feet (3862 mm).
- F. Limit height of vertical grout lifts to not more than 60 inches (1524 mm). ACI compliant procedure for higher grout lift may be submitted for approval. Place and consolidate grout fill without displacing reinforcing.
- G. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.
- H. Grout hollow metal frames installed into masonry walls.

3.09 CONTROL AND EXPANSION JOINTS

- A. Provide control joints in concrete masonry unit walls at the locations as indicated, or if not indicated at not more than 25-feet o.c. or at a panel ratio of not more than 1.5:1. Refer to NMCA TEK 10-2C for joint locations with respect to openings and corners.
- B. Do not continue horizontal joint reinforcement through control or expansion joints.
- C. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- D. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- E. Form expansion joint as detailed on drawings.

3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, glazed frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.11 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.12 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.14 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect sills, ledges, and projections from mortar droppings.
 - 2. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

END OF SECTION

SECTION 04 72 00
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.
- B. Units required are:
 - 1. Exterior wall units, primarily custom cast ornaments (winged wheels).
 - 2. Other items indicated on drawings.

1.02 RELATED REQUIREMENTS

- A. Section 04 01 20 - Maintenance of Masonry: repairs, mortar and grout to match existing.
- B. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- G. ASTM C150/C150M - Standard Specification for Portland Cement.
- H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- I. ASTM C1364 - Standard Specification for Architectural Cast Stone.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Mortar Color Selection Samples.
- E. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
 - 2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
 - 3. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
 - 4. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Cast Stone:
 - 1. Edwards Cast Stone, 777 Edwards Road, Dubuque, IA 52003; 563.556.0535; www.edstone.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
 - 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - 2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 - 3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 - 4. Color: Match existing.
 - 5. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 - 1. Custom castings to replicate original three-dimensional ornamentation required.
 - 2. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 - 3. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.

- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: as specified in Section 04 01 20.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.
- C. Mechanically anchor each cast stone unit.
- D. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
 - 1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
 - 2. Repair methods and results subject to Architect's approval.

3.04 CLEANING

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 - 1. Wet surfaces with water before applying cleaner.
 - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 - 4. Do not use acidic cleaners.

3.05 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.
 - 1. Canopy framing and components.
- B. Miscellaneous angles, channels, tubes, plates, brackets and fasteners, as required to complete the project, including but not limited to:
 - 1. Loose angle lintels
- C. Slotted Channel Adjustable Framing System
- D. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 06 10 00 - Rough Carpentry: concealed blocking or substrate for items specified in this section.
- D. Section 09 91 23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: provide for fabricated items listed in 1.01A above.

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 3. Where installing items to existing precast concrete, concrete or masonry, propose connections not detailed for structural engineer approval.
- C. Samples: 12-inch long finished sections of custom jamb plates.

1.05 QUALITY ASSURANCE

- A. Design members and connections under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Fabricate steel items in accordance with AISC "Steel Construction Manual."

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Bolts, Nuts, and Washers: ASTM A307, galvanized to ASTM A153/A153M where connecting galvanized components.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- K. Anchoring Devices:
 1. Anchor Rods: Anchor rods used with structural steel members shall be plain steel rods conforming to ASTM F1554 (Grade 36), complete with suitable nuts and washers, unless noted otherwise.
 2. Expansion Bolts: Expansion anchors shall consist of one-piece wedge type carbon steel anchor bolts with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633.
 - a. Structural Applications
 - 1) Acceptable products must have a valid and current ICC report, as listed at www.icc-es.org <<http://www.icc-es.org>>.
 - b. Non-Structural Applications
 - 1) Acceptable Manufacturers and products: Hilti Fastening Systems- Kwik Bolt III Anchor; ITW Red Head Mechanical Anchoring Systems - Trubolt Wedge Anchor; Powers Fastening Inc - Power-Stud Anchor; (or approved equivalent)
 3. Epoxy Adhesive Anchoring System: Epoxy anchoring shall consist of a threaded rod and the epoxy adhesive cartridge.
 - a. Structural Applications
 - 1) Acceptable products must have a valid and current ICC report, as listed at www.icc-es.org <<http://www.icc-es.org>>.
 - b. Non-Structural Applications

- c. Acceptable Manufacturers and products: Hilti Fastening System - HIT RE 500; ITW Red Head Adhesive Anchoring Systems - Epcon C6 Adhesive; Powers Fastening Inc. - PE1000+; (or approved equivalent).
- L. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 5,000 psi at 28 days.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds, where welding is indicated.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Welded Joints: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously where visible or where exposed to moisture, even if intermittent or stitch welds are structurally adequate, and to comply with the following:
 - 1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by continuous welds.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.03 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of non-structural members; prime paint finish.
- B. Lintels: As detailed or as scheduled in Structural Notes; galvanized for field finish.
 - 1. Size loose lintels to provide bearing length at each side of opening to be 1/12 its length, but not less 6 inches, unless noted otherwise.
- C. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.
 - 1. Product: System of channel members and bolted connections fabricated to support loads without welded connections.
 - 2. Fittings and accessories shall be fabricated from hot rolled, pickled and oiled steel plates meeting the requirements of ASTM A 575.
 - 3. Nuts and screws shall be Unified and American coarse screw thread meeting the requirements of ASTM A 576 GR1015 (nut), and ASTM A 307 and SAE J429 GR2 (screw).
 - 4. Nuts and screws shall be electro-galvanized (EG) coated to commercial standards meeting the requirements of ASTM B 633 Type III SC1 finish.
 - 5. Finish: Adjustable framing shall be pre-finished with Unistrut's Perma-Green II; B-Line's Dura Green; or equal. All miscellaneous accessories, brackets, and fittings shall match framing.
 - 6. Manufacturer: Unistrut Corporation Unistrut; B-Line Systems, Inc. Powerstruct; or equal.
- D. Entrance Canopy Framing and Components: steel tubes, channels, plates, angles and tie-rods; as detailed.

1. Finishes: G90 galvanized for concealed steel members, primed for high-performance coating on exposed steel members.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 1. Exceptions: Galvanize items to be embedded in concrete, items to be imbedded in masonry, and concealed exterior items.
 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prime Painting: One coat.
- C. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- D. Powder-Coating of steel members indicated to be powder-coated: two-coat system consisting of a powder primer and a second coat suitable for an exterior environment with UV exposure, conforming to AAMA 2605
 1. Film thickness: 80 um for primer, 160 um for coating.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Examine substrates and site area for conditions that might prevent satisfactory installation.
 1. Where installing items to existing precast concrete, concrete or masonry, propose connections not detailed for structural engineer approval.
- C. Verify that dimensions of supporting structure are within plus/minus 1/8 inch of dimensions shown on shop drawings.
- D. Verify that all adjacent painting, roofing, masonry work, and other work that might damage prefinished items has been completed prior to installation.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.
- C. Remove all mill scale, rust, grease, foreign matter and surface imperfections from steel components that will be painted to ensure a smooth, even appearance of finish.

3.03 INSTALLATION

- A. Install premanufactured items in accordance with manufacturer's installation instructions.
- B. Install items plumb and level, accurately fitted, free from distortion or defects.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Anchor units to structure as indicated on the drawings.
- E. Field weld components as indicated on shop drawings.
 1. Perform field welding in accordance with AWS D1.1/D1.1M.

- F. Obtain approval prior to site cutting or making adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
- H. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors. Grout voids as required to result in secure installation.
- I. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/8 inch per story or 10 feet, non-cumulative.
- B. Maximum Offset From True Alignment: 1/8 inch in 10 feet.
- C. Maximum Out-of-Position: 1/8 inch in 48 inches.

3.05 CLEANING

- A. Clean exterior surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.06 PROTECTION

- A. Protect items after installation to prevent damage due to other work until Date of Substantial Completion

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Subflooring.
- B. Preservative treated wood materials.
- C. Communications and electrical room mounting boards.
- D. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. Structural Drawing Notes: for Cold-Formed Metal Framing information
- B. Section 09 91 23 - Interior Painting: painting of exposed mounting boards.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- C. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood.
- F. PS 1 - Structural Plywood.
- G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
- H. PS 20 - American Softwood Lumber Standard.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on panel products.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Engineered wood products containing added urea-formaldehyde are not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.

- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 1 or Construction Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
 - 1. Bond Classification: Exposure 1.
 - 2. Span Rating: 48.
 - 3. Performance Category: 3/4 PERF CAT.
 - 4. Edges: Tongue and groove.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Concealed Backing for wall-mounted items- provide backing as required for loading from one of the following:
 - 1. Dimension Lumber: as noted above
 - 2. Plywood: as noted below
- D. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
 - 3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
- B. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed; adhesives designed for subfloor applications and complying with either ASTM C557 or ASTM D3498.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.
 - e. Treat lumber less than 18 inches above grade.
 - f. Treat lumber in other locations as indicated.
 - 2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.

- a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
- b. Treat plywood in contact with roofing, flashing, or waterproofing.
- c. Treat plywood in contact with masonry or concrete.
- d. Treat plywood less than 18 inches above grade.
- e. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards, tack boards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.
 - 10. Wall-protection items, including corner guards.
 - 11. TVs and monitors.
 - 12. Owner-provided wall-mounted equipment, whether owner-installed or contractor-installed.

3.03 INSTALLATION OF CONSTRUCTION PANELS

- A. Subflooring/Underlayment Combination: Screw to framing; staples are not permitted.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.04 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.

- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.05 CLEANING

- A. Waste Disposal:
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

3.06 SCHEDULES

- A. Comm/Electrical Room Mounting Boards: 8 feet tall, all walls, painted white.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items, including:
 - 1. Wood wall paneling and base (WD1).
- B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 09 93 00 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.
- C. PS 1 - Structural Plywood.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with electrical rough-in and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Samples: Submit two samples of finish wall paneling 12 by 12 inch in size illustrating specified finish.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company that follows AWI's "Architectural Woodwork Quality Standards".
 - 2. Fabricator of this section must also provide work specified in Section 06 41 00 - Architectural Wood Casework.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.08 FIELD CONDITIONS

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, utilities, and other related work to ensure that finish carpentry items can be supported and installed as indicated.

- B. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. During and after installation of finish carpentry, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
- D. Do not deliver product until the building is secure and weathertight.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Interior Woodwork Items:
 - 1. Solid Wood Wall Paneling: owner-provided wood planks (old bowling alley flooring), sanded with transparent finish.

2.02 LUMBER MATERIALS

- A. Hardwood Lumber (WD1): Owner-provided bowling alley flooring.
 - 1. Application: wood wall panel, and base if indicated.
 - 2. Mounting: mount planks on solid substrate prior to mounting on wall.
 - 3. Finish: sanded, filled, and finished with water-based polyurethane clear sealer.

2.03 SHEET MATERIALS

- A. Softwood Plywood, concealed: Face species Contractor's choice, plain sawn, veneer core; PS 1 Grade A-B, glue type as recommended for application.
 - 1. Thickness: as detailed or required for application and span.
 - 2. Grading: Certified by the American Plywood Association.

2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners for substrate: screws, any finish in concealed locations.
- C. Fasteners at wood paneling: Trim nails of size and type to suit application; filled.

2.05 ACCESSORIES

- A. Lumber for Shimming: Softwood lumber of pine species.
- B. Wood Filler: Solvent base, tinted to match surface finish color.
- C. Wood Panel Retainers or Z-clips: aluminum, 1/4" nominal projection, lengths as required for weight of wood component, with predrilled holes.
 - 1. Acceptable Manufacturers:
 - a. Fry Reglet: Graph Modular Wall System; www.fryreglet.com
 - b. Monarch Metal Fabrication; www.monarchmetal.com
 - c. Orange Aluminum; www.orangealuminum.com
 - d. New York Metal; www.newyorkmetal.com
 - e. Outwater Plastics Industries Inc; www.outwatercatalogs.com
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Wood Panel Trim:
 - 1. Aluminum - Heavy weight extruded aluminum 6063-T5 alloy; clear or natural finish.
 - 2. Configuration: See details for locations
 - 3. Depths: as required to achieve intent of details based on wood product thickness.
 - 4. Acceptable Manufacturers:
 - a. Fry-Reglet Corporation; Graph Modular Wall System: www.fryreglet.com
 - b. Marlite; Surface Systems - MAP System (mechanically-attached panels); www.marlite.com
 - c. Stylmark; www.stylmark.com
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 SITE FINISHING MATERIALS

- A. Finishing: Field finished as specified in Section 09 93 00.

2.07 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.08 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 11, Polyurethane, Catalyzed.
 - b. Stain: as indicated in Interior Finish Schedule to match Architect's sample
 - c. Sheen: Satin.
- E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
- C. See Section 06 10 00 - Rough Carpentry for installation of concealed wood blocking.

3.02 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Do not begin installation until wood materials have been fully acclimated to interior conditions.
- C. Set and secure materials and components in place, plumb and level.
- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- E. Install paneling with nails at 8 inch on center.
- F. Set exposed fasteners, fill with wood filler, and finish to match panel finish.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Cabinet hardware and accessories.
- C. Tackable surface (TACKABLE).
- D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 07 92 00 - Joint Sealers: sealant at millwork and countertops at walls
- C. Section 12 36 00 - Countertops.
- D. Division 22 - Plumbing: coordination of drop-in sinks, plumbing fixture trim and connections
- E. Division 26 - Electrical: coordination of lighting and electrical trim and connections.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.
- C. NEMA LD 3 - High-Pressure Decorative Laminates.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Provide casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required. Indicate materials, component profiles, configurations, assembly methods, fastening methods, jointing details, utility and service requirements and locations, accessory listings, hardware location and schedule of finishes.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Product Data: Provide data for hardware accessories.
- D. Finish Verification Samples:
 - 1. For each finish product specified, two each, 3 inches x 5 inches, of colors and finishes selected by architect.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.05 DESIGN REQUIREMENTS

- A. Reinforce frame and support counters in all areas, to safely support a load of 200 lbs (90 kg) concentrated on one square foot (0.093 sq m) in any area with no indentation showing on surface and with permanent set not exceeding 0.005 inch (0.127 mm).

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
- B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept casework on site. Inspect on arrival for damage.

- B. Protect units from moisture, soiling, or damage during handling and installation.
- C. Protect work surfaces throughout the construction period with corrugated cardboard covering the top and securely taped to edges.

1.08 FIELD CONDITIONS

- A. Coordinate casework installation with size, location and installation of service utilities.
- B. Coordinate layout and installation of blocking and reinforcement in walls for support of casework.
- C. Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- E. Do not deliver product until the following conditions are met:
 - 1. Windows and doors are installed and the building is secure and weathertight.
 - 2. Ceiling, overhead ductwork and lights are installed.
 - 3. All painting is completed and floor tile is installed.
- F. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

1.09 SCOPE OF THE CASEWORK SUPPLIER/INSTALLER:

- A. Casework and accessories: Furnish to building, and unpad and/or uncrate, set in place, level and fasten all specified casework and equipment.
- B. Clean up: Remove debris, dirt, and rubbish accumulated as a result of delivery of this equipment and leave premises broom clean and orderly.
- C. ADA-Americans With Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on architectural plans as "ADA," at public spaces or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:
 - 1. Countertop height: with or without cabinet below, not to exceed a height of 34 inches A.F.F., (Above Finished Floor), at a surface depth of 24 inches.
 - 2. Kneespace clearance: to be a minimum 27 inches A.F.F., and 30 inches clear span width. $\frac{3}{4}$ " inch deep shelving, adjustable or fixed: not to exceed a range from 9 inches A.F.F. to 54 inches A.F.F.
 - 3. Sink cabinet clearances: in addition to F.1., 2. above, upper kneespace frontal depth to be no less than 8 inches, and lower toe frontal depth to be no less than 11 inches, at a point 9 inches A.F.F.
- D. Fillers, scribes, access holes: Provide all necessary fillers and scribes for a complete job. Provide all access holes in cabinets and countertops required by mechanical, electrical, and HVAC contractors.

1.10 SCOPE NOT COVERED BY CASEWORK SUPPLIER/INSTALLER:

- A. Service to and within equipment: Furnishing piping system, traps, drain lines, and conduit within equipment, in service turrets or tunnels, through, under or along backs of working surfaces and in reagent racks above countertops.
- B. Setting of plumbing fixtures and accessory fixtures, and final connections of such.
- C. Plumbing services: Furnishing, installation and connection of traps, drain lines, drop-in sinks, vents, steam fittings and special plumbing fixtures or piping to meet local codes, whether or not specifically called for in the contract documents.
- D. Electrical services: Furnishing and installation of rigid and flexible conduit, fittings, and special electrical equipment and accessories, wire, pulling of wire, and wiring and connection to

electrical boxes, receptacles, switches, lights, and flush plates. Work shall be in accordance with local codes, whether or not specifically called for in the contract documents.

- E. Bracing and supports: Furnishing and installation of all framing and reinforcements of wall, floors and ceilings necessary to adequately support the equipment, and all bucks and plaster grounds required for proper installation of equipment. Casework supplier/installer to direct others as to the type of bracing required and the location needed.
- F. Base molding 4" or 6" high applied to casework, furnished and installed by flooring contractor.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Cabinets:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Concealed Surfaces: Melamine, color as selected by Architect from manufacturer's full range.
 - 4. Door and Drawer Front Edge Profiles: Square edge with PVC edge-banding.
 - 5. Casework Construction Type: Type A - Frameless.
 - 6. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
 - a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
 - 7. Adjustable Shelf Loading: 50 lbs. per sq. ft.
 - a. Deflection: L/144.
 - 8. Cabinet Style: Flush overlay.
 - 9. Cabinet Doors and Drawer Fronts: Flush style.
 - 10. Drawer Construction Technique: Dovetail joints, with glue.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

- A. Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as follows:
 - 1. Concealed Surfaces: Species - contractors choice.
- B. Hardwood Lumber: NHLA; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as follows:
 - 1. Concealed Surfaces: Species - contractors choice.

2.04 PANEL MATERIALS

- A. Softwood Plywood, Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B, glue type as recommended for application.
- B. Particleboard: ANSI A208.1; Composed of wood chips, sawdust, or flakes of medium density (minimum 45-pound), pressure bonded with waterproof resin binders, of grade to suit application; unsanded faces; thickness as required.
 - 1. No urea-formaldehyde adhesive.

2.05 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. **BASIS OF DESIGN:** Formica Corporation: www.formica.com/#sle.
 - 2. Panolam Industries International, Inc; Nevamar: www.panolam.com/#sle.

3. Panolam Industries International, Inc; Pionite: www.panolam.com/#sle.
 4. Wilsonart LLC: www.wilsonart.com/#sle.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. High Pressure Decorative Laminate (PLAM#): NEMA LD 3, types as recommended for specific applications.
1. Manufacturers/Product/Style/Color: as indicated in Finish Schedule
- C. Provide specific types as follows:
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as scheduled.
 3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected.
 4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

- A. Countertops are specified in Section 12 36 00.

2.07 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded 3 mm PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's full range.
 2. Use at all exposed plywood edges.
 3. Use at all exposed shelf edges.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Countertop Support Brackets: see Section 12 36 00 - Countertops.
- G. Tackable Surface (TACKABLE): Composition cork, antibacterial, with self-healing surface.
1. Manufacturers:
 - a. **BASIS OF DESIGN:** Koroseal: Walltalkers Tac Wall
 - b. MooreCo, Inc: www.moorecoinc.com.
 - c. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
 - d. Polyvision Corporation (Nelson Adams): www.polyvision.com
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Cork Thickness: 1/4 inch (6 mm), shipped in 4 foot rolls.
 3. Color: As indicated Finish Schedule, or if not indicated, as selected from manufacturer's full range.
 4. Backing: Burlap.
 5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E 84.
 6. Location/Size: As indicated on drawings.
 7. Frame: None.

2.08 HARDWARE

- A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome or satin chrome finish, for nominal 1 inch spacing adjustments.
1. Product: 346ANO manufactured by Knappe and Vogt.

- B. Tab Drawer Pull: 4" long tab pull, 1 1/2" projection, 3" on center; satin chrome
 - 1. Product: Doug Mockett DP3B or approved equal.
- C. Cabinet Locks: Keyed cylinder, two keys per lock, steel with satin finish.
 - 1. Application: lock where specifically noted to be keyed.
 - 2. Key removable in the locked and unlocked position.
 - 3. Deadbolt cylinders compatible with keying system noted in Section 08 71 00.
 - 4. Product: Olympus 700 SC (doors) or 800 SC (drawers); 7/8" or 1-3/8"
- D. Drawer Slides:
 - 1. Type: Full extension with overtravel.
 - 2. Static Load Capacity: Extra Heavy Duty grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide soft-closing/stay closed type.
 - 6. Manufacturers:
 - a. Accuride International, Inc: www accuride.com.
 - b. Grass America Inc: www.grassusa.com.
 - c. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Hinges: European style concealed self-closing type, steel with satin finish.
 - 1. 110 degree opening
 - 2. Manufacturers:
 - a. Grass America Inc: www.grassusa.com.
 - b. Hafele; www.hafele.com
 - c. Hardware Resources: www.hardwareresources.com.
 - d. Julius Blum, Inc: www.blum.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Door Swing Restrictor: for use in preventing casework doors from opening and striking adjacent walls
 - 1. Concealed method for european hinges (Contractor to coordinate with hinge manufacturer):
 - a. Dura Supreme Cabinetry: Hinge Restriction Clip
 - b. Grass TEC 864 85 Degree Hinge Angle Reduction Clip
 - c. Rockler: Blum Restrictor Clip
 - d. Approved equal
- G. Wall Cleats: French cleats for stud wall partitions, with lower cleat fastened to wall and upper cleat fastened to millwork.
- H. Concealed panel clips: black plastic male-female fitting;
 - 1. Product: Hafele Keku Push-in Fitting or approved equal; black plastic or finish to match hinges.
- I. Closet Rods: Steel tubing for wall mounting in flange fittings; round stainless steel, standard duty; 1-1/16 inch outside diameter, 0.087 inch wall thickness

2.09 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Fully finish exposed cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets and counter bases to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- H. Seal joint between back/end splashes and vertical surfaces.
- I. Provide matching casework filler panel to occupy remaining space between casework and adjacent walls as necessary to accommodate for field dimensions.

3.03 INSTALLATION ITEMS BY TRADE CONTRACTOR

- A. Install plumbing and electrical service to and within equipment.
- B. Set plumbing fixtures and accessory fixtures, and make final connections of such.
- C. Complete wiring and connection to electrical boxes, receptacles, switches, lights, and flush plates. Work shall be in accordance with local codes, whether or not specifically called for in the contract documents.
- D. Close ends of units, splash aprons, shelves and bases with sealant.

3.04 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.
- B. Clean all materials provided under this section and all adjacent materials, which may have become soiled from this work.
 - 1. High Pressure Laminates (HPL): refer to NEMA publication Ld3-2005 Annex B Care and Cleaning of Laminates.
- C. Wipe out millwork interiors and empty drawers of dirt and debris. Remove pencil marks and other blemishes from millwork surfaces.
- D. Remove foreign matter that could affect operation or appearance of hardware.

- E. Make final adjustments to drawers and doors. Doors shall swing freely. All doors shall be aligned both vertically and horizontally. Drawers shall open and close smoothly, without binding or excessive slide and play.

3.06 PROTECTION OF FINISHED WORK

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Cover with protective cover, taped to casework.
- C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 07 01 50.19
ROOFING REPAIR AND REPLACEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Partial removal and patching of existing roofing system as required for new work.

1.02 RELATED REQUIREMENTS

- A. Section 02 41 00 - Demolition; disposal of materials.
- B. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

1.04 REFERENCE STANDARDS

- A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- C. FM DS 1-28 - Wind Design; Factory Mutual Research Corporation; 2007.
- D. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with affected mechanical and electrical work associated with roof penetrations.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
- C. Meet at Project site with the following attendees:
 - 1. Construction Manager or General Contractor
 - 2. Roofing Installer
 - 3. Installers of deck or substrate construction to receive roofing work,
 - 4. Installers of rooftop equipment and other associated work that must precede or follow roofing work
 - 5. Architect
 - 6. Owner or Owner's construction representative
 - 7. Roofing system manufacturer's representative
 - 8. Additional installers of any associated work
- D. Review preparation and installation procedures and coordinating and scheduling required with related work.
 - 1. Review methods and procedures related to roofing work.
 - 2. Review structural loading or penetration limitations of deck.
 - 3. Verify new equipment will fit existing penetrations and roof curbs or what modifications need to occur for new equipment.
 - 4. Review roofing systems requirements and compliance with NRCA standards.
 - 5. Review required submittals, both completed and yet to be completed.
 - 6. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 7. Review required inspection, testing, certifying, and material usage accounting procedures.
 - 8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including provision of temporary roofing.
 - 9. Record discussion of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements

exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit for each type of material, including membrane materials, insulation, surfacing, and fasteners used for patching existing membrane.
- C. Shop Drawings: Indicate size, configuration, installation details, termination detail conditions, conditions of interface with existing materials.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
 - 1. When same installer as new roofing system, comply with related requirements of section indicated for new roofing system.
 - 2. Approved by existing roofing system warrantor to work on existing warranted roof system.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.
- D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.09 FIELD CONDITIONS

- A. Existing Roofing System: TPO or PVC single-ply roofing.
- B. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.
- C. Remove only existing roofing materials that can be replaced with new materials the same day.
- D. Coordinate the work with other affected trades and building occupants.
- E. Coordinate with roof accessories and sheet metal accessory items, including other devices to be coordinated with the roofing work as specified in other sections to avoid conflict or omission in waterproofing systems and to provide watertight installation.
- F. Maintain continuous temporary protection prior to and during installation of new roofing system.
- G. Provide notice at least three days before starting activities that will affect normal building operations.
- H. Owner will occupy building areas directly below re-roofing area.
 - 1. Provide Owner with at least 72 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
 - 2. Do not disrupt Owner's operations or activities.
 - 3. Maintain access of Owner's personnel to corridors, existing walkways, and adjacent buildings.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.
 - 1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.

2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.
 - a. Submit documentation upon project closeout.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Protection: Sheet fiber reinforced plastic; provide weights to retain sheeting in position.
 1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.02 ACCESSORIES

- A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials as the weather will permit.
- B. Remove metal counter flashings as required to perform work outlined.

3.04 PROTECTION

- A. Provide protection of existing roofing system that is not having work performed on it.
- B. Provide temporary protective sheeting over uncovered deck surfaces.
- C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.
- D. Provide for surface drainage from sheeting to existing drainage facilities.
- E. Do not permit traffic over unprotected or repaired deck surface.

3.05 SCHEDULES

- A. Patching: Remove roofing membrane, insulation, vapor retarder (if any) and flashings as indicated and only as required for new rooftop equipment and tie-in work. Patch back with same, and as required to maintain existing warranty.
 1. Existing Roofing Membrane: Contractor to verify.
 2. Existing Roofing Installer: unknown.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Batt insulation in interior floor construction.
- B. Foamed-in-Place insulation for
 - 1. Filling exterior wall crevices.
 - 2. Filling perimeter window and door shim spaces
 - 3. At junctions of dissimilar wall and roof materials.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- B. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- F. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C.
- G.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation in Wood Framed Floor Structure: Batt insulation with no vapor retarder.
- B. Insulation for filling joints, crevices and shim spaces: Foamed-in-place.

2.02 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Facing: Unfaced.
 - 5. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.

- c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation:
www.ocbuildingspec.com/#sle.
- d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FOAMED-IN-PLACE INSULATION

- A. Shim Space Insulation: Polyurethane type, single component spray foam system, reduced expansion spray foam system; semi-rigid; closed cell.
 - 1. Application: Fill shim spaces in window, curtain wall and entrance framing, for sealing seams in board insulation within the joint, and joints greater than 1/8" between furring and insulation.
 - 2. Thermal Value (R), Minimum: 4.50 per inch, when tested in accordance with ASTM C 518.
 - 3. Density: 1.3 lb/cu ft, when tested in accordance with ASTM D 1622.
 - 4. Flame Spread: 20, when tested in accordance with UL 1715 Fire Test.
 - 5. Smoke Development: 25, when tested in accordance with UL 1715 Fire Test.
 - 6. Product:
 - a. Convenience Products: "Touch 'n Seal No-Warp Foam".
 - b. Hilti: "CF 812 Window and Door Pro Low-Pressure Filler Foam".
 - c. Approved equivalent.

2.04 ACCESSORIES

- A. Insulation Retainers: manufacturer's standard for horizontal applications.
- B. Adhesive: Type recommended by insulation manufacturer for application.
 - 1. Must show compatibility with adjacent products.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.
- C. Verify substrate materials are compatible with insulation & adhesives.

3.02 PREPARATION

- A. Spray Foam:
 - 1. Mask and protect adjacent surfaces from over spray or dusting.
 - 2. Apply primer in accordance with manufacturer's instructions.

3.03 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior raised floor spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Retain insulation batts in place with spindle fasteners at 12 inches on center, or as recommended by manufacturer.

3.04 SPRAY FOAM INSULATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids. Do not exceed manufacturer's recommended thickness per application.

- C. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- D. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- G. CDA A4050 - Copper in Architecture - Handbook.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 3 by 5 inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sheet Metal Flashing and Trim Manufacturers:
 - 1. Petersen Aluminum Corporation; Pac-Clad: www.pac-clad.com/sle.
 - 2. Ryerson: ColorKlad/AlumaKlad; www.ryerson.com.

2.02 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Difluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: Black, as selected by Architect from manufacturer's full range.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with fluoropolymer coating.
 - 1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: Black, as selected by Architect from manufacturer's full range.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with batten seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA (ASMM), Square profile, seamless
- B. Downspouts: Square profile, open front.
- C. Scuppers and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA Architectural Sheet Metal Manual.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Downspout Boots: Steel.
- F. Seal metal joints.
- G. Accessories: include gutter screens.

2.05 ACCESSORIES

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolt, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.

2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed with hex washer heads.
 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 4. Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. Use stainless steel fasteners.
- C. Slip Sheet: Rosin sized building paper.
 - D. Primer: Zinc chromate type.
 - E. Protective Backing Paint: Zinc molybdate alkyd.
 - F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
 - G. Concealed Sealants: Non-curing butyl sealant.
 - H. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
 - I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Conform to drawing details.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

3.04 SCHEDULE

- A. Gutters and Downspouts: prefinished steel
- B. Coping, Cap, Parapet Flashings: prefinished aluminum
- C. Sill and Ledge Flashings: prefinished aluminum
- D. Flashings and Counterflashings at aluminum-framed openings: prefinished aluminum.
- E. Counterflashings at Roofing Terminations (over roofing base flashings): prefinished galvanized steel.
- F. Counterflashings at Curb-Mounted Roof Items: pre-finished galvanized steel.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 70 00 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems.
- D. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.
- E. ITS (DIR) - Directory of Listed Products.
- F. FM (AG) - FM Approval Guide.
- G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168.
- H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.
- I. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
 - 1. VOC Data: provide printed statement of VOC content of non-preformed sealants
- D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated, ASTM E119, and ASTM E814.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained by manufacturer.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Nelson FireStop Products: www.nelsonfirestop.com.
 - 5. Specified Technologies Inc: www.stifirestop.com/#sle.
 - 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

2.04 MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specified diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillow/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.05 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- B. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.06 FIRESTOPPING SYSTEMS

- A. Firestopping:
 - 1. Fire Ratings: See drawings for required systems and ratings.
- B. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches or less: Any material meeting requirements.
 - 1. Available UL-Classified Systems: C-BJ-2001-2999 and W-L-2001-2999.
- C. Firestopping at Insulated Pipes, of diameter 4 inches or less: Any material meeting requirements.
 - 1. Available UL-Classified Systems: C-BJ-5001-5999 and W-L-5001-5999.
- D. Firestopping at Cable Tray Penetrations: Any material meeting requirements.
 - 1. Available UL-Classified Systems: W-L-4001-4999.
- E. Firestopping at Cable Penetrations, not in Conduit or Cable Tray: Any material meeting requirements.
 - 1. Available UL-Classified Systems: C-BJ-3001-3999, W-L-6001-6999 and W-L-3001-3999.
- F. Firestopping at Control Joints (without Penetrations): Any material meeting requirements.
 - 1. Available UL-Classified Systems: C-BJ-0001-0999 and W-L-0001-0999.
- G. Firestop Systems for Miscellaneous Penetrants: Any material meeting requirements.
 - 1. Available UL-Classified Systems: W-J-7001-7999 and W-L-7001-7999.

- H. Firestop Systems for Groupings of Penetrants: Any material meeting requirements.
 - 1. Available UL-Classified Systems: C-BJ-8001-8999 and W-L-8001-8999.

2.07 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.
- B. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping: Firestopping sealants.
- B. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
- C. Section 08 80 00 - Glazing: Glazing sealants and accessories.
- D. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- E. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- B. ASTM C834 - Standard Specification for Latex Sealants.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants.
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Installation Log: Submit filled out log for each length or instance of sealant installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
- C. Installation Plan: Include schedule of sealed joints, including the following.
 - 1. Installation Log Form: Include the following data fields, with known information filled out.
 - a. Unique identification of each length or instance of sealant installed.
 - b. Location on project.
 - c. Substrates.
 - d. Sealant used.
 - e. Stated movement capability of sealant.
 - f. Primer to be used, or indicate as "No primer" used.
 - g. Size and actual backing material used.
 - h. Date of installation.
 - i. Name of installer.
 - j. Actual joint width; provide space to indicate maximum and minimum width.
 - k. Actual joint depth to face of backing material at centerline of joint.
 - l. Air temperature.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
 - 1. For silicone sealants within 20 years.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. Adhesives Technology Corporation: www.atcepoxy.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Chem Link, Inc: www.chemlinkinc.com.
 - 4. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 - 5. Fortifiber Building Systems Group: www.fortifiber.com/sle.
 - 6. Hilti, Inc: www.us.hilti.com/#sle.
 - 7. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
 - 8. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
 - 9. Pecora Corporation: www.pecora.com/?sle.
 - 10. Sherwin-Williams Company: www.sherwin-williams.com.
 - 11. Sika Corporation: www.usa-sika.com.
 - 12. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 13. W.R. Meadows, Inc: www.wrmeadows.com/sle.
 - 14. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 - 1. Adhesives Technology Corporation: www.atcepoxy.com.

2. Bostik Inc: www.bostik-us.com.
3. Dayton Superior Corporation: www.daytonsuperior.com.
4. Dow Corning Corporation: www.dowcorning.com/construction/sle.
5. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
6. Pecora Corporation: www.pecora.com/?sle.
7. Sherwin-Williams Company: www.sherwin-williams.com.
8. Sika Corporation: www.usa-sika.com.
9. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
10. W.R. Meadows, Inc: www.wrmeadows.com/sle.
11. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

- A. Type 1 - General Purpose Exterior Sealant - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M, G, O and A; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Color: To be selected by Architect from manufacturer's standard range.
 6. Cure Type: Single-component, neutral moisture curing.
 7. Applications:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Control, expansion, and soft joints in masonry.
 - f. Joints between concrete and other materials.
- B. Type 2 - Sanitary Sealant - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: White.
 2. Manufacturers:
 - a. BASF Building Systems; Omniplus.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - d. Pecora Corporation: www.pecora.com.
 - e. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
 - f. Tremco Incorporated; Tremsil 200 Sanitary..
 3. Applications:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- C. Type 3 - Wet Area Floor Sealant - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.

3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Applications:
 - a. Interior control and expansion joints in concrete floors considered wet areas.
- D. Type 4 - Acoustical Sealant - Acrylic-Urethane Sealant: Water-based; ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
 2. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.
 3. Color: White.
 4. Applications:
 - a. In sound-rated wall assemblies, and where not indicated as fire-rated:
 - 1) gaps between top stud runner and structure, between bottom stud track and floor, between gypsum wall board and floor, and between gypsum wall board and structure.
 - 2) gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
- E. Type 5 - General Purpose Interior Sealant - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 1. Color: To be selected by Architect from manufacturer's standard range.
 2. Grade: ASTM C834; Grade - NF.
 3. Applications:
 - a. Interior wall and ceiling control joints in non-wet areas.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Other interior joints for which no other type of sealant is indicated.
- F. Type 6 - Moving Joint Sealant - Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
 1. Applications:
 - a. Lap Joints in Sheet Metal Fabrications
 - b. Lap Joints between Manufactured Metal Panels

2.04 SELF-LEVELING SEALANTS

- A. Type 7 - Exterior Pavement Sealant - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Color: Gray.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Applications:
 - a. Control and Expansion Joints in Concrete Paving
- B. Type 8- Interior Slabs (unpolished) - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 1. Composition: Single or multi-component, 100 percent solids by weight.
 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 3. Color: To be selected by Architect from manufacturer's standard colors.
 4. Joint Width, Minimum: 1/8 inch.
 5. Joint Width, Maximum: 1/4 inch.
 6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.

7. Manufacturers:
 - a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - b. Metzger/McGuire; MM-80
 - c. Nox-Crete Inc; DynaFlex 502: www.nox-crete.com/#sle.
 - d. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates and joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 3. Record each test on Preinstallation Adhesion Test Log as indicated.
 4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.

- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 - 1. Width/depth ratio of 2:1.
 - 2. Neck dimension no greater than 1/3 of the joint width.
 - 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Do not seal the following types of joints.
 - 1. Intentional weepholes in masonry.
 - 2. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - 3. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - 4. Joints where installation of sealant is specified in another section.
 - 5. Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
- I. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- J. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

3.06 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Fire-rated hollow metal doors and frames.
- C. Thermally insulated hollow metal doors with thermally-broken hollow metal frames.
- D. Hollow metal borrowed lites glazing frames.
- E. Accessories, including glazing.

1.02 RELATED REQUIREMENTS

- A. Section 08 14 16 - Flush Wood Doors
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- D. Section 09 91 13 - Exterior Painting: Field painting.
- E. Section 09 91 23 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. SDI: Steel Door Institute.
- C. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- J. ASTM C476 - Standard Specification for Grout for Masonry.
- K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- M. ITS (DIR) - Directory of Listed Products.
- N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

- O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
- P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.
- Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
- R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- U. UL (DIR) - Online Certifications Directory.
- V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, or Curries, Assa Abloy Group companies: www.assaabloydss.com.
 - 2. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/sle.
 - 5. West Central Manufacturing: www.westcentralmfg.com
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Exterior (Thermally-Broken) Hollow Metal Doors and Frames:
 - 1. Ceco or Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM

- A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 3. Door Top Closures: Flush end closure channel, with top and door faces aligned.
 4. Door Edge Profile: Beveled, both sides.
 5. Rabbet: single, unless otherwise indicated.
 6. Typical Door Face Sheets: Flush.
 7. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
 8. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - a. Steel Door Reinforcing:
 - 1) Minimum 10 gauge steel of equivalent thread depth for hinges.
 - 2) Minimum 12 gauge steel for lock front, closers, and overhead hold open/stop arms.
 - 3) Minimum 14 gauge steel for other hardware.
 - b. Steel Frame Reinforcing:
 - 1) Minimum 7 gauge steel of equivalent thread depth for hinges.
 - 2) Minimum 12 gauge steel for closers and overhead hold open/stop arms.
 - 3) Minimum 14 gauge steel for strikes and other hardware.
 9. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for exterior and corrosive locations.
- B. Hollow Metal Panels: Same construction, performance, and finish as doors.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
 2. Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
 3. U value: 0.36, measured in accordance with ASTM C1363/ NFRC 102-2014
 4. Air Infiltration: less than 0.1 cfm/sf measured in accordance with ASTM EE283/ NFRM 400-2014.
 5. Must use with thermally broken frame and thermal saddle to achieve above values.
 6. Door Thickness: 1-3/4 inches, nominal.
 7. Weatherstripping: Refer to Section 08 71 00.
- C. Interior Doors, Non-Fire Rated:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

- a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
- 2. Core Material: Vertical steel stiffeners with fiberglass or mineral fiber batt infill.
- 3. Door Thickness: 1-3/4 inches, nominal.
- D. Interior Doors, Fire-Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
 - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - b. Attach fire rating label to each fire rated unit.
 - 3. Core Material: Vertical steel stiffeners with fiberglass or mineral fiber batt infill, except where mineral fiberboard required for rating or temperature rise.
 - 4. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
 - 1. ANSI A250.8 Level 3 door and Doors over 4'-0" wide: 14 gauge frames.
 - 2. Frames for Wood Doors and other doors: 16 gauge.
- B. Exterior Door Frames: Fully welded.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 - 3. Provide thermal anchors, and use with energy efficient door and thermal saddle
 - 4. Weatherstripping: Separate, see Section 08 71 00.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- D. Door Frames, Fire-Rated: Fully welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
- I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 ACCESSORIES

- A. Glazing: As specified in Section 08 80 00, factory installed.
- B. Removable Stops: Formed sheet steel, mitered corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Section 08 71 00.
- D. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
 - 1. Coordinate with painter so that silencers are not painted.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install batt insulation at frames in gypsum board walls. Install spray foam insulation at frames at exterior walls.
- F. Install door hardware as specified in Section 08 71 00.
- G. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- H. Comply with glazing installation requirements of Section 08 80 00.
- I. Coordinate installation of electrical connections to electrical hardware items.
- J. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

- B. Between Bottom of Door and Top of Threshold: Standard bottom clearance as required by manufacturer.
- C. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 6 by 6 inches in size illustrating wood grain, stain color, and sheen.
- E. Specimen warranty.
- F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.07 PROJECT CONDITIONS

- A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors: Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty:
 - 1. Algoma Hardwoods: www.algomahardwoods.com
 - 2. Eggers Industries: www.eggersindustries.com.
 - 3. Graham Wood Doors: www.grahamdoors.com.
 - 4. Marshfield Door Systems, Inc: www.marshfelddoors.com.
 - 5. Oshkosh Door Company: www.oshkoshdoor.com.
 - 6. VT Industries: www.vtindustries.com..
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
 - 3. No added urea-formaldehyde.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Wood veneer facing with factory opaque finish to match Architect's sample.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer; lumber or veneer (ME), or compatible hardwood (CE), sanded ease; visible joints allowed on hinge edge.
- B. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.
- C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - 2. Provide solid blocking for other through-bolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Opaque:
 - a. System - 11, Polyurethane, Catalyzed.
 - b. Color: As selected by Architect.
 - c. Sheen: Semigloss.
- B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Opaque:
 - a. System - OP-6, Catalyzed Polyurethane.
 - b. Color: As selected by Architect.
 - c. Sheen: Semigloss.
- C. Factory finish doors in accordance with approved sample.
- D. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 11 13.
- B. Glazing: See Section 08 80 00.
- C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.
- D. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- 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.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ceiling mounted access units.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: substrate
- B. Section 09 91 23 - Interior Painting: Field paint finish.
- C. Division 22 - Plumbing: piping components requiring access.
- D. Division 23 - HVAC: mechanical components requiring access.
- E. Division 26 - Electrical: electrical components requiring access.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- C. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- F. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Schedule: List of wall or ceiling access doors required, per room, with quantity and sizes of each.
- D. Project Record Documents: Record actual locations of each access unit.

1.05 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CEILING-MOUNTED UNITS

- A. Manufacturers:
 - 1. Activar Construction Products Group - JL Industries: www.activarcpg.com/#sle.
 - 2. ACUDOR Products Inc: www.acudor.com/#sle.
 - 3. Babcock-Davis: www.babcockdavis.com.
 - 4. Cendrex, Inc: www.cendrex.com/#sle.

5. Milcor, Inc: www.milcorinc.com.
 6. Nystrom, Inc: www.nystrom.com/#sle.
 7. Williams Brothers Corporation of America: www.wbdoors.com.
 8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated
 2. Style: as follows:
 - a. At gypsum board: Use drywall bead type frame.
 3. Door Style: Single thickness with rolled or turned in edges.
 4. Frames: 16 gage, 0.0598 inch, minimum thickness.
 5. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
 6. Finish:
 - a. At gypsum board: Steel Finish: Primed.
 7. Size: As indicated or as required for maintenance access. Minimum 16 x 16-inch.
 8. Hardware:
 - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.175 degree with non-removable pin.
 - b. Handle: No handle.
 - c. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Install access doors in gypsum board walls before joints are taped and finished, or arrange for taping and mudding of access door flanges after installation.
- D. Position units to provide convenient access to concealed equipment when necessary.

3.04 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
 - 1. Exterior storefront and punched openings.
 - 2. Interior partitions.
- B. Infill panels of glass.
- C. Aluminum doors and frames.
- D. Aluminum frames for wood doors.
- E. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Custom aluminum jamb closure plates.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 08 14 16 - Flush Wood Doors: doors installed in frames provided by this section.
- D. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- E. Section 08 80 00 - Glazing: Glass and glazing accessories.
- F. Section 12 24 00 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples 4 by 12 inches in size illustrating finished aluminum surface.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide ten year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MANUFACTURERS

- A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.
- B. Aluminum-Framed Storefront and Doors:
 1. Kawneer North America; Trifab: www.kawneer.com.
 2. **BASIS OF DESIGN:** Oldcastle Building Envelope; Series 3000 Multi-plane (thermal) and FG-3000 (non-thermal): www.oldcastlebe.com.
 3. Tubelite, Inc: www.tubeliteinc.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ALUMINUM-FRAMED STOREFRONT

- A. Interior Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Rabbet: For 1/4 inch monolithic glazing.
 2. Glazing Position: Centered (front to back).
 3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 4. Finish (Exterior and Council Chambers): Class I color anodized.

- a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - c. Finish Color: Black.
- 5. Finish (Interior Offices): Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- 6. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
- 7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
- 8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- 9. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
- 10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
- 11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- 12. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.
- 13. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.
- B. Aluminum-Framed Swing Doors: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Unitized, shop assembly.
 - 2. Glazing Rabbet: For 1 inch insulating glazing at exterior; 1/2-inch at interior partitions.
 - 3. Finish: to match adjacent aluminum framing.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
 - 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
- C. Performance Requirements for Exterior Units:
 - 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Positive Design Wind Load: 40 lbf/sq ft.
 - b. Negative Design Wind Load: 40 lbf/sq ft.
 - c. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 - 2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 12 psf.
 - 3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
 - 4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
 - 5. Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F), maximum.

2.04 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Flush.
- B. Glazing: As specified in Section 08 80 00.
- C. Swing Doors: Glazed aluminum.
 - 1. Thickness: 2 inches, thermally broken for exterior entrances.
 - a. 1-3/4 inches acceptable for interior non-thermal doors.
 - 2. Top Rail: 4 inches wide.
 - 3. Vertical Stiles: 4-1/2 inches wide.
 - 4. Bottom Rail: 10 inches wide.
 - 5. Glazing Stops: Square.
 - 6. Finish: to match adjacent storefront.

2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- C. Fasteners: Stainless steel.
- D. Sealant for Setting Thresholds: Non-curing butyl type.
- E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- F. Glazing Accessories: As specified in Section 08 80 00.
- G. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.06 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.
 - 1. Color: Black.

2.07 HARDWARE

- A. For each exterior door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: As specified in Section 08 71 00.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all exterior doors.
- E. Threshold: Extruded aluminum, one piece per door opening, non-slip surface; provide on all exterior doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.

- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Provide spray-foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Install glass in accordance with Section 08 80 00, using gasket glazing method.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- 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

1.2 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. 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.
- E. 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.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.3 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. 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.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. 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.
- G. 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
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.6 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual surface door closer bodies.
 - 4. Ten years for heavy duty floor closers.
 - 5. Two years for shallow depth floor closers.
 - 6. Five years for motorized electric latch retraction exit devices.
 - 7. Two years for electromechanical door hardware.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 5. Manufacturers:
 - a. Ives (IV).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - c. Stanley Hardware (ST) - CB Series.
- 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. Manufacturers:
 - a. Bommer Industries (BO).
 - b. Ives (IV).
 - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
- C. Floor Closers: ANSI/BHMA A156.4 certified floor closers. Provide independent and adjustable valves for closing speed, latch speed, and backcheck with built-in dead stop and hold open features as specified. Provide finished cover plates or thresholds as indicated in door Hardware Sets.

1. Manufacturers:

- a. Dorma Products (DO).
- b. Rixson Door Controls (RF).

- D. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:

- a. Architectural Builders Hardware (AH).
- b. Ives (IV).
- c. Rixson Door Controls (RF).

2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
- b. Securitron (SU) - EL-CEPT Series.
- c. Von Duprin (VD) - EPT-10 CON Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.
- c. Von Duprin (VD) – Equivalent to above listed McKinney tools.

2. Manufacturers:

- a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

- b. Von Duprin (VD) – CON Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. 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.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (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.
- 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: Manufacturer's Standard.
- D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.
 - a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
 2. Manufacturers:
 - a. Sargent Manufacturing (SA) - Degree Series.
 - b. Corbin Russwin (RU) – Access 3 Series.
 - c. Schlage (SC) – Everest Series.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. New System: Key locks to a new key system as directed by the Owner.
- F. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- G. Construction Keying: Provide construction master keyed cylinders.
- H. 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.
- I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
 - a. Lund Equipment (LU).
 - 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, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 10 million cycles.
 - 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – ML2000 Series.
 - b. Sargent Manufacturing (SA) – 8200 Series.
 - c. Schlage (SC) – L9000 Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
 - 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 - 2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 - 3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.
 - 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML20900 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Schlage (SC) - L9000 EL/EU/RX Series.
- B. Electromechanical Multi-Point Locks: Vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Rods are retracted by dual mounted outside lever trim controls available in a variety of ANSI/BHMA operational functions. Option for single top latching only eliminates the need for bottom strikes. Electromechanical options include solenoid activated trim, electric latch retraction, and inside and outside lever monitoring.
 - 1. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) MP9800 Series.
 - b. Sargent Manufacturing (SA) – 7000 Series.
 - c. Schlage (SC) – LM9000 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. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.9 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. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 7. 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.
 8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 11. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.
 12. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) - 35A/98 Series.

2.10 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 as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): 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 body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. LCN Closers (LC) - 4040XP Series.
 - c. Norton Door Controls (NO) – 9500 Series.
 - d. Sargent Manufacturing (SA) - 281 Series.

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
1. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (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. Manufacturers:
 - a. Glynn Johnson (GJ).

- b. Rixson Door Controls (RF).
- c. Sargent Manufacturing (SA).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 - 2. Reese Enterprises, Inc. (RE).

2.13 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. Manufacturers:
 - a. Security Door Controls (SD) - DPS Series.
 - b. Securitron (SU) - DPS Series.
- B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include 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 plus 50% for the specified electrified hardware and access control equipment.

1. Manufacturers:

- a. Alarm Controls (AK) - APS Series.
- b. Securitron (SU) - BPS Series.
- c. Von Duprin (VD) - PS.

2.14 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.

2.15 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. 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.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:

- 1. MK - McKinney
- 2. PE - Pemko
- 3. RF - Rixson
- 4. RO - Rockwood
- 5. SA - SARGENT
- 6. NO - Norton
- 7. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 100.2

1 Continuous Hinge	CFM83SLI-HD1 x Height Required	PE
1 Rim Exit Device, Storeroom	DG1 AD8504 Less Pull	US32D SA

1 Pull	RM201 Mtg-Type 1XHD	US32D	RO
1 Conc Overhead Stop	1-X36	630	RF
1 Door Closer	281 P10	EN	SA
1 Drop Plate	281D	EN	SA
1 Blade Stop Spacer	581-2	EN	SA
1 Threshold	253x3AFG		PE
1 Sweep	3452CNB TKSP8		PE

Notes: Door normally closed, latched and secure.
Entry by key override.
Free egress at all times.

Set: 2.0

Doors: H102

1 Continuous Hinge	CFM83HD1 PT x Height Required		PE
1 Fail Secure Exit Device	DG1 55 8876 ETND	US32D	SA
1 Surf Overhead Stop	9-X36	630	RF
1 Door Closer	281 PD10	EN	SA
1 Threshold	253x3AFG		PE
1 Rain Guard	346A TKSP8		PE
1 Gasketing	2891APK TKSP8		PE
1 Sweep	3452CNB TKSP8		PE
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Exit Device)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BPS-24-1		SU
1 Set Of Wiring Diagrams			00

Notes: Door normally closed, latched and secure.
Entry by valid credential or key override.
Free egress at all times.
Install gasketing prior to soffit mounted hardware. Do not notch gasketing for soffit mounted hardware hardware.

Set: 3.0

Doors: 101

2 Floor Closer	27S	626	RF
4 Intermediate Pivot	M19	626	RF
2 Concealed Vert Rod Exit, Nightlatch	DG1 AD8410 106 x Less Pull	US32D	SA
2 Concealed Vert Rod Exit, Exit Only	AD8410 EO	US32D	SA
2 Ladder Pull	RM3302-16 Mtg-Type 1XHD	US32D	RO

Notes: Doors normally closed, latched and secure.
Entry by pulls when door manually dogged down by hex key in exit device rail or key override.
Free egress at all times.

Set: 4.0

Doors: 120

8 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
2 Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	DG1 8204 LNND	US26D	SA
1 Door Closer	281 O	EN	SA
2 Wall Stop	400	US26D	RO

Notes: Mount closer on active leaf only.

Set: 5.0

Doors: 118

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG1 8204 LNND	US26D	SA
1 Door Closer	281 O	EN	SA
1 Wall Stop	400	US26D	RO
1 Gasketing	S88D		PE
1 Sweep	18061CNB TKSP		PE

Set: 6.0

Doors: 104.1

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	DG1 RX 8271 LNND	US26D	SA
1 Door Closer	281 O	EN	SA
1 Wall Stop	400	US26D	RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BPS-24-1		SU
1 Set Of Wiring Diagrams			00

Notes: Door normally closed, latched and secure.
Entry by valid credential or key override.
Free egress at all times.

Set: 7.0

Doors: H100.1

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Fail Secure Lock	DG1 RX 8271 LNND	US26D	SA
1 Door Closer	281 P10	EN	SA
1 Wall Stop	400	US26D	RO
1 Electric Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P (Frame - EPT to Power/Controller)		MK
1 ElectroLynx Harness	QC-CxxxP (Door - EPT to Elec. Lock)		MK
1 Position Switch	DPS-M / W		SU
1 Power Supply	BPS-24-1		SU
1 Set Of Wiring Diagrams			00

Notes: Door normally closed, latched and secure.
Entry by valid credential or key override.
Free egress at all times.

Set: 8.0

Doors: 112, 119, 121, 122, 122-1, S100, S101, S101A

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG1 8204 LNND	US26D	SA
1 Door Closer	281 O	EN	SA
1 Wall Stop	400	US26D	RO

Set: 9.0

Doors: H100.2

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG1 8204 LNND	US26D	SA
1 Door Closer	281 P10	EN	SA
1 Wall Stop	400	US26D	RO

Set: 10.0

Doors: 113

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG1 8204 LNND	US26D	SA
1 Door Closer	281 O	EN	SA
1 Wall Stop	400	US26D	RO

Notes: Always locked from inside of room, unlocked from outside of room

Set: 11.0

Doors: 105, 106, 107, 108, 109, 110

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	DG1 8205 LNND	US26D	SA
1 Wall Stop	400	US26D	RO

Set: 12.0

Doors: 104.2, 114, 116

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	8215 LNND	US26D	SA
1 Wall Stop	400	US26D	RO

Set: 13.0

Doors: 115, 117

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	8215 LNND	US26D	SA
1 Door Closer	281 O	EN	SA
1 Wall Stop	400	US26D	RO

Set: 14.0

Doors: 115A, 115B, 117A, 117B, R100, R101

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set w/ Indicator	V21 EMB 8265 LNND	US26D	SA
1 Wall Stop	400	US26D	RO

Set: 15.0

Doors: 100.1

4 Hinge	TA2714 FT 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C-RKW	US32D	RO
1 Pull Plate	BF 111x70C	US32D	RO
1 Door Closer	281 P10	EN	SA
1 Wall Stop	400	US26D	RO

Mark	Hardware
100.1	15.0
100.2	1.0

101	3.0
104.1	6.0
104.2	12.0

105	11.0
106	11.0
107	11.0

108	11.0
109	11.0
110	11.0
112	8.0
113	10.0
114	12.0
115	13.0
115A	14.0
115B	14.0

116	12.0
117	13.0
117A	14.0
117B	14.0
118	5.0
119	8.0
120	4.0
121	8.0
122	8.0

122-1	8.0
H100.1	7.0
H100.2	9.0
H102	2.0
R100	14.0
R101	14.0
S100	8.0
S101	8.0
S101A	8.0

END OF SECTION 087100

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units, for storefront and entrance doors.
- B. Glazing units, for interior glazing.
- C. Mirrors, frameless.
- D. Channels for frameless interior partitions.
- E. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.
- E. Section 10 14 05 - Applied Graphics: custom-printed surface-applied glazing film.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D. ASTM C1036 - Standard Specification for Flat Glass.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- J. GANA (GM) - GANA Glazing Manual.
- K. GANA (SM) - GANA Sealant Manual.
- L. NFRC 100 - Procedure for Determining Fenestration Product U-factors.
- M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- N. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit, Glazing Unit, and Mirror Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
 - 1. On mirror glass: mastic, and edge trim.

- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 12 by 12 inch in size of each type of insulated glass units showing coloration and thermal spacer design.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials:
 - 1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years experience and approved by manufacturer.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- C. Store products in manufacturer's unopened packaging until ready for installation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Manufacturer's Special Warranty for Silvered Mirrored Glass: Written warranty, made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined below, within Five years from date of manufacture, but not less than three years from date of Substantial Completion.
 - 1. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fabricators:
 - 1. Oldcastle Building Envelope
 - 2. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
 - 3. Viracon, Inc: www.viracon.com/#sle.
 - 4. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Float Glass Manufacturers:
 - 1. AGC Glass North America, Inc: www.agcglass.com/#sle.
 - 2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 3. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 4. Pilkington North America Inc: www.pilkington.com/na/#sle.

5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
6. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 1. Design Pressure: see Structural Notes in Drawings.
 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 2. To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapor retarder and air barrier seal.
 3. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
- B. Mirror Glass: Clear Annealed Float Glass: 1/4 inch thick. ASTM C 1036, Type I (transparent glass, flat), Class 1 (clear), Quality q2 (mirror) with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.
 1. Mirror Edges: polished.
 2. Edge Angles: stainless steel channels top and bottom- see accessories section below
 3. Sizes: as indicated in drawings.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Any of the manufacturers specified for float glass.
 2. AGC Glass North America, Inc: www.agcglass.com/#sle.
 3. Cardinal Glass Industries: www.cardinalcorp.com.
 4. Guardian Industries Corp: www.sunguardglass.com.
 5. Oldcastle Glass; www.oldcastleglass.com.
 6. Pilkington North America Inc: www.pilkington.com/na.
 7. Viracon, Apogee Enterprises, Inc: www.viracon.com/#sle.

8. **BASIS OF DESIGN (FOR IG UNITS):** Vitro (formerly PPG Industries, Inc); Solarban 70XL: www.ppgideascales.com.
 9. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Exterior glazing comply with specified requirements for wind load design regardless of specified thickness.
 4. Warm-Edge Spacers: Low conductivity thermoplastic and stainless steel.
 - a. Spacer Width: As required for specified insulating glass unit.
 - b. Spacer Height: 0.27 inch.
 - c. Manufacturers:
 - 1) Technoform Glass Insulation; TGI-Spacer: www.glassinsulation.us/#sle.
 - 2) Substitutions: Refer to Section 01 60 00 - Product Requirements.
 5. Spacer Color: match framing color.
 6. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 7. Color: Black.
 8. Purge interpane space with dry air, hermetically sealed.
- C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Locations as indicated on drawings.
 2. Space between lites filled with argon.
 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E (passive type), on #2 surface.
 4. Inboard Lite: Laminated float glass, 3/8 inch thick, minimum.
 - a. Tint: Clear.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value), Winter - Center of Glass: .28, minimum.
 7. Visible Light Transmittance (VLT): 64 percent, minimum.
 8. Shading Coefficient: 32 percent, nominal.
 9. Solar Heat Gain Coefficient (SHGC): 27 percent, nominal.
 10. Visible Light Reflectance, Outside: 12 percent, nominal.
 11. Glazing Method: Dry glazing method, gasket glazing.
- D. Insulating Glass Units: Safety glazing.
1. Applications:
 - a. Glazed lites in exterior doors.
 - b. Glazed sidelights and panels next to doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 2. Space between lites filled with argon.
 3. Glass Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.

2.05 GLAZING UNITS

- A. Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Fully tempered float glass.

3. Tint: Clear.
 4. Thickness:
 - a. G-1: 1/2-inch
 - b. G-2: 1/4-inch
 5. Glazing Method: Dry glazing method, gasket glazing.
- B. Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 2. Glass Type: Fully tempered safety glass as specified.
 3. Tint: Clear.

2.06 ACCESSORIES

- A. Sidelight Fittings (offices): extruded aluminum channels, for semi-recessed installation in construction above and below glazing panels for frameless appearance.
 1. Sizes: as detailed.
 2. Finish: Clear (natural) anodized aluminum.
- B. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- C. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color black.
- E. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.
 1. Gunther Mirror Mastics.
 2. Palmer Products Corporation.
 3. Sommer and Maca (Somaca).
 4. Substitutions: Section 016000 - Product Requirements.
- F. Mirror Accessories: See Section 09 30 00 - Tiling; for metal transitions used with recessed mirrors.
- G. Partition Strip (for butt-glazed glass panels): Clear copolymer strip for 180 degree glass-to-glass joints; full-height; depths are required for glass thickness.
 1. Application: all butt-glazed panels
 2. CR Laurence Co. EZCC (EZCE for perpendicular abutments and EZCL for 90 degree corners) or approved equal.

2.07 FABRICATION

- A. Mirror Edge Treatment: Flat polished. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.

- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - MIRRORS

- A. Install mirrors in accordance with GANA recommendations.
- B. Coordinate with installer of adjacent wall tile to assure that mirror and tile are installed flush with each other and with a uniform joint at the perimeter for sealant.
- C. Set mirrors with edge clearance free of surrounding construction.
- D. Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Carpet tile.
 - 3. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- F. Remedial floor coatings.
- G. Remedial floor sheet membrane.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs; vapor retarders under new slabs.

1.03 DEFINITIONS

- A. MVE: Moisture Vapor Emission.
- B. MVER: Moisture Vapor Emission Rate; measured in lbs per1000 ft2 / 24 hours.
- C. RH: Relative Humidity; measured in percentage.
- D. VOC: Volatile Organic Compound; measured in grams/liter.
- E. CSP: Concrete Surface Profile defined by ICRI.

1.04 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.
- B. Pre-Installation Meeting:
 - 1. Convene minimum two weeks prior to starting work of this section.

2. Discuss contract document requirements, moisture tests, manufacturer recommendations, installer's recommendations, scheduling, and protection of work from damage by other trades.
3. Attendance required by: Contractor, Floor Installer, Manufacturer's Representative, Independent testing agency, Concrete Subcontractor, Ready Mix supplier.
4. Objective of conference is:
 - a. Review methods and procedures.
 - b. Tour job site representative areas to inspect and discuss condition of substrate.
 - c. Review concrete finishing requirements.
 - d. Review and finalize construction schedule to ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
 - e. Review required inspections, testing, certifications, material usage procedures.
 - f. Review environmental restrictions and forecasts.
 - g. Confirm compatibility of MVE control coatings with other concrete chemicals specified.
 - h. Record content of conference including attendance and topics.
5. Furnish record of pre-installation conference to all parties who are affected by MVE control systems work.

1.06 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 1. Moisture and alkalinity (pH) limits and test methods.
 2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 1. Manufacturer's qualification statement.
 2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 4. Manufacturer's installation instructions.
 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- D. Testing Agency's Report:
 1. Description of areas tested; include floor plans and photographs if helpful.
 2. Summary of conditions encountered.
 3. Moisture and alkalinity (pH) test reports.
 4. Copies of specified test methods.
 5. Recommendations for remediation of unsatisfactory surfaces.
 6. Product data for recommended remedial coating.
 7. Submit report to Architect.
 8. Submit report not more than two business days after conclusion of testing.
- E. Adhesive Bond and Compatibility Test Report.
- F. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

1.07 QUALITY ASSURANCE

- A. Supply all components of MVE Control System from single source manufacturer.
- B. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

- C. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- D. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- E. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.09 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Application: All existing concrete slabs; and new slabs where required by flooring manufacturer based on required test results.
- B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
 - 2. ASTM F3010 qualified, fluid-applied, two-component, 100 percent solids epoxy resin, low viscosity, penetrating, one-coat membrane forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor covering indicated, including adhesives.
 - 3. Products:
 - a. Allied Construction Technologies, Inc. (ACTech), GoEarly Technology; www.atechperforms.com
 - b. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
 - c. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
 - d. ISE Logik: MVEC 700; www.iselogik.com
 - e. Koster American Corporation; Koster VAP 1 2000: www.kosterusa.com.

- f. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
 - g. MAPEI Americas: Planiseal VS or VS Fast; www.mapei.com/US-EN
 - h. Maxxon Corporation: MVP; www.maxxoncorporation.com
 - i. TEC, an H.B. Fuller Construction Products Brand; TEC LiquiDam EZ with TEC Level Set 200 SLU: www.tecspecialty.com/#sle.
 - j. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.
 - k. UZIN, a division of UFLOOR Systems Inc; UZIN PE 460 with UZIN PE 280 and UZIN NC 170 LevelStar: www.ufloorsystems.com/#sle.
 - l. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
- 1. Thickness: 28 mil (0.028 inch).
 - 2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.
 - 3. Products:
 - a. GCP Applied Technologies; Kovara 95: www.gcpat.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
- 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 - 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
 - a. Do not attempt to remove coating or penetrating material.
 - b. Do not abrade surface.
 - 3. Preliminary cleaning.
 - 4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 - 5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 7. Specified remediation, if required.
 - 8. Patching, smoothing, and leveling, as required.
 - 9. Other preparation specified.
 - 10. Adhesive bond and compatibility test.
 - 11. Protection.
- B. Remediations:
- 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 - 2. Excessive Moisture Emission or Relative Humidity: apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 - 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive

for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
 - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
 - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds,

then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.10 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

- A. Install in accordance with sheet membrane manufacturer's instructions.

3.11 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.
- H. Painting of above-ceiling firewall warning signs required by code.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- C. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
- G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- H. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- M. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.
- N. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

- O. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
- P. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- S. ASTM E413 - Classification for Rating Sound Insulation.
- T. GA-216 - Application and Finishing of Gypsum Board.
- U. UL (FRD) - Fire Resistance Directory.
- V. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 - 2. Marino: www.marinoware.com.
 - 3. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 - 4. The Steel Network, Inc: www.SteelNetwork.com.
 - 5. PAC International, Inc. www.pac-intl.com.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.

1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi (275 MPa) minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
 - a. Acceptable Products:
 - 1) Dietrich Metal Framing; UltraSteel (tm): www.dietrichindustries.com.
 - 2) Clark Western Building Systems; UltraSteel (tm): www.clarkwestern.com.
2. Studs: C-shaped with knurled or embossed faces.
3. Runners: U shaped, sized to match studs.
4. Ceiling Channels: T-shaped.
5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
6. Furring: "C" shaped studs, in depths of 1.1/2 and 3 inches, in locations indicated.
- C. Z-Furring: Z furring channel, minimum 0.0179 inch thick base metal; depths as indicated
- D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
 3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- E. Non-structural Framing Accessories:
 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - b. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.
 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
 - a. Products:
 - 1) ClarkDietrich; FastBridge Clip (FB33): www.clarkdietrich.com/#sle.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.
- F. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
 1. Products:
 - a. USG Corporation; Drywall Suspension System: www.usg.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. American Gypsum Company: www.americangypsum.com.
 2. CertainTeed Corporation: www.certainteed.com.
 3. Continental Building Products: www.continental-bp.com.
 4. Georgia-Pacific Gypsum: www.gpgypsum.com.
 5. National Gypsum Company: www.nationalgypsum.com.
 6. PABCO Gypsum: www.pabcogypsum.com.

7. USG Corporation: www.usg.com.
 8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 5. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
 - b. American Gypsum Company; FireBloc Type C Gypsum Wallboard.
 - c. CertainTeed Corporation; Type C Drywall.
 - d. CertainTeed Corporation; Type X Drywall.
 - e. Continental Building Products; Firecheck Type C.
 - f. Continental Building Products; Firecheck Type X.
 - g. Georgia-Pacific Gypsum; ToughRock Fireguard X.
 - h. Georgia-Pacific Gypsum; ToughRock Fireguard C.
 - i. National Gypsum Company; Gold Bond BRAND Fire-Shield Gypsum Board.
 - j. USG Corporation; USG Sheetrock Brand Firecode X Panels: www.usg.com/#sle.
 - k. Substitutions: See Section 01 60 00 - Product Requirements.
 6. Mold Resistant Paper Faced Products:
 - a. CertainTeed Corporation; M2Tech 5/8" Type C Moisture & Mold Resistant Drywall.
 - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
 - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board.
 - f. National Gypsum Company; Gold Bond 3/4" Ultra-Shield FS XP Gypsum Board.
 - g. USG Sheetrock Brand UltraLight Mold Tough
 - h. USG Sheetrock Brand Mold-Tough Firecode X
 - i. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Backing Board For Wet Areas:
1. Application: Surfaces behind tile in wet areas including restrooms and locker rooms.
 2. Application: Horizontal surfaces behind tile in wet areas including floors.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 4. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Application: floors
 - b. Thickness: 1/4 or 3/8, as recommended by manufacturer based on substrate inch.
 - c. Products:
 - 1) Custom Building Products: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 - 3) USG Corporation: www.usg.com/#sle.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.

5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Application: walls
 - b. Regular Type: Thickness 1/2 inch.
 - c. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
 - d. Products:
 - 1) CertainTeed Corporation; Diamondback GlasRoc Tile Backer.
 - 2) Georgia-Pacific Gypsum; DensShield Tile Backer.
 - 3) National Gypsum Company; Gold Bond eXP Tile Backer.
 - 4) USG Durock Brand Glass-Mat Tile Backerboard
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.
6. Edges: Tapered.
- D. Board For Non-Wet (Damp) Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 1. Application: untiled toilets and janitorial areas (all walls and ceilings), and areas around sinks or equipment with water connections.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Type X Thickness: 5/8 inch.
 4. Regular Board Thickness: 5/8 inch.
 5. Edges: Tapered.
 6. Products:
 - a. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
 - b. National Gypsum Company; Gold Bond XP Gypsum Board.
 - c. USG; Sheetrock Brand Mold Tough Gypsum Panels
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 INSULATION MATERIALS

- A. Mineral Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 1. Application: At interior walls for acoustic insulation.
 2. Density: 2.5 pcf.
 3. Thickness: as required to meet STC rating indicated.
 4. Facing: Unfaced.
 5. Products:
 - a. Thermafiber SAFB.
 - b. Roxul"AFB".
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, rolled zinc, or stainless steel, unless noted otherwise.
 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) Amico "Zip Strip" preferred, where applicable,
 - 2) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
 - 3) Trim-Tex, Inc; Tear-Away Beads: www.trim-tex.com.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Tape: 2 inch wide, coated glass fiber tape for joints and corners at glass mat-faced board.
 2. Tape: 2 inch wide, creased paper tape for joints and corners at paper-faced board.

3. Joint Compound: Drying type, vinyl-based, ready-mixed.
4. Joint Compound: Setting type, field-mixed.
- D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- E. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard unless noted more restrictively on drawings..
 1. Level ceiling system to a tolerance of 1/1200.
 2. Laterally brace entire suspension system.
- C. Studs: Space studs at 16 inches on center.
 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- G. Blocking: Install wood blocking or mechanically fastened steel sheet blocking for support of:
 1. Framed openings.
 2. Countertop and shelf supports
 3. Wall mounted cabinets.
 4. Plumbing fixtures.
 5. Toilet partitions.
 6. Toilet accessories.
 7. Wall-mounted door hardware.
 8. Wall hooks
 9. Chalkboards, tack boards, and marker boards.
 10. Owner provided wall mounted equipment, whether owner-installed or contractor-installed.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
 1. Do not compress insulation.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 1. Place one bead continuously on substrate before installation of perimeter framing members.

2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - a. Include walls to receive printed graphic wall coverings (Section 10 14 05 - Applied Graphics)
 - b. Include corridor and lobby walls longer than 20 feet.
 2. Level 4: Walls and ceilings to receive other paint finishes, unless otherwise indicated.
 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
 - a. Include temporary partitions.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- E. Where Level 5 finish is indicated, slightly thin all-purpose joint compound, roll on wall with 24-inch roller and wipe down with drywall knife.

3.07 FIRE WALL MARKING

- A. Refer to Code Analysis Plans and to Reflected Ceiling Plans. At all fire-rated or smoke-partition walls that are located adjacent to accessible (acoustical) ceiling tiles or an accessible attic/ceiling space, provide permanent stenciling indicating hourly rating.

1. Lettering shall be a minimum 3-inch high with 3/8-inch minimum stroke in a contrasting color incorporated the suggested wording, "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS" or similar wording.
2. Markings shall be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet, measure horizontally along the wall or partition.
3. Markings shall be on both sides of all rated partitions and in every adjacent room.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications (TL#).
- B. Tile for wall applications (TL#).
- C. Non-ceramic trim for corners, edges and base.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.
- C. Section 10 28 00 - Toilet, Bath, and Laundry Accessories; coordination
- D. Section 22 40 00 - Plumbing Fixtures: coordination of fixtures

1.03 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement.
- D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.
- E. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
- F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.
- G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.
- H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
- I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.
- J. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
- K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar.
- L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- M. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.
- N. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- O. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

- P. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.
- Q. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.
- R. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles.
- S. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.
- D. Samples: Mount tile and apply grout on one plywood panel, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- G. Maintenance Materials:
 - 1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

1.08 WARRANTY

- A. Correct defective Work within a two year period after Date of Substantial Completion.
- B. Grout:
 - 1. Materials will be free from manufacturing defects from the time of purchase and conform to manufacturer's written specifications under normal usage for a period of ten years when applied according to manufacturer's written installation instructions and industry standard guidelines.
 - 2. Must be used with setting materials from same manufacturer

PART 2 PRODUCTS

2.01 TILE

- A. Porcelain Tile (TL1, TL2, TL3): ANSI A137.1, standard grade.
 - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - 2. Size(s): varies, as indicated in Finish Schedule.
 - 3. Thickness: 3/8 inch.
 - 4. Manufacturer/ Style/ Color/ Pattern:
 - a. Provide Basis of Design manufacturer listed in the Finish Schedule, or a standard or custom product from one of the other listed manufacturers approved prior to bid, with

- equivalent performance, material properties, features, general configuration, appearance, and warranty.
- b. Substitutions: See Section 01 60 00 - Product Requirements.
- 5. Application/ Location: As indicated in Finish Drawings and Finish Schedule.
- 6. Install Method: As indicated in Finish Schedule.

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Anodized aluminum, style and dimensions as indicated on drawings, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. Open edges of wall tile.
 - b. Open edges of floor tile.
 - c. Transition between floor finishes of different heights.
 - 2. Manufacturers:
 - a. Genesis APS International: www.genesis-aps.com/#sle.
 - b. Profilitec; www.profilitec.com.
 - c. **BASIS OF DESIGN:** Schluter-Systems: www.schluter.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Finish: Clear anodized.
 - 4. Products:
 - a. Edge-Protection and Transition Profiles from Tile to Carpet: L-shaped profile with 1/8 inch wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer; Schluter-SCHIENE.
 - b. Edge-Protection and Transition Profiles for Tile to lower floors: trapezoid-shaped reducing strip profile with 3/8 inch wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer; Schluter-RENO-U.
 - c. Edge-Protection at recessed mirror: L-shaped profile with 1/8 inch wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer; Schluter-SCHIENE.

2.03 SETTING MATERIALS

- A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 - 1. Applications: Use this type of bond coat where indicated at areas that are not continually wet.
 - 2. Provide setting materials from the same manufacturer as the grout used for that particular tile application.
 - 3. Products:
 - a. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 - b. Bostik Inc; Single-Flex FS; www.bostik-us.com
 - c. Custom Building Products: www.custombuildingproducts.com/#sle.
 - d. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com/#sle.
 - e. Mapei; www.mapei.com
 - f. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
 - g. ProSpec, an Oldcastle brand: www.prospec.com.
 - h. TEC, an H.B. Fuller Construction Products Brand; TEC 3N1 Performance Mortar: www.tecspecialty.com/#sle.
 - i. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

- A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated in Interior Finish Schedule.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As indicated in Interior Finish Schedule (one custom required).

4. Products:
 - a. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - d. Mapei: Keracolor S
 - e. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
 - f. TEC, an H.B. Fuller Construction Products Brand; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 20 mils, maximum.
 - c. Products:
 - 1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - 2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
 - 3) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09 05 61.
 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles square.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
- B. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with specified grout.

3.05 INSTALLATION - WALL TILE

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system, for acoustical units.
- B. Acoustical units (ACT1).

1.02 RELATED REQUIREMENTS

- A. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.
- B. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- C. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.
- D. Section 28 46 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Maintenance Materials:
 - 1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide 20 year manufacturer warranty for sag-resistant ceiling tiles.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide Basis of Design manufacturer listed in the Finish Schedule, or a standard or custom product from one of the other listed manufacturers approved prior to bid, with equivalent performance, material properties, features, general configuration, appearance, and warranty.
- B. Acoustic Tiles/Panels:
 - 1. **BASIS OF DESIGN:** Armstrong World Industries, Inc: www.armstrong.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
 - 4. USG: www.usg.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Suspension Systems:
 - 1. Same as for acoustical units.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tiles (ACT1): Mineral fiber with membrane-faced overlay, with the following characteristics:
 - 1. Classification: ASTM E1264 Type IV.
 - a. Form: 2, water felted.
 - b. Pattern: "E" - lightly textured.
 - 2. Size: 24 by 24 inches.
 - 3. Thickness: 3/4 inch.
 - 4. Light Reflectance: 88 percent, determined in accordance with ASTM E1264.
 - 5. NRC: 0.75, minimum, determined in accordance with ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 7. Panel Edge: Reveal.
 - 8. Tile Edge: Beveled.
 - 9. Color: White.
 - 10. Suspension System: Semi-exposed grid.
 - 11. Products:
 - a. **BASIS OF DESIGN:** Armstrong World Industries, Inc; Ultima: 1912; www.armstrongceilings.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

- A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Semi-Concealed Suspension System: Hot-dipped galvanized steel grid and cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 9/16 inch face width.
 - 3. Finish: Baked enamel.
 - 4. Color: White.
 - 5. Products:
 - a. **BASIS OF DESIGN:** Armstrong: Suprafine
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions and specified Seismic Design Category.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.

- 3. Double cut and field paint exposed reveal edges.
- F. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring (LVT).
- B. Resilient base (RB#).
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 09 30 00 - Tiling; transitions associated with ceramic tile flooring, walls and base.
- D. Section 09 68 14 - Tile Carpeting; flooring requiring resilient base and transitions associated with carpeting.

1.03 REFERENCE STANDARDS

- A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
- B. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base.
- D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute.
- E. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Verification Samples: Submit two samples, 9 by 9 inch minimum, in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Maintenance Materials:
 - 1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum five years experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.

- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Provide installation area that is weather tight and maintained either permanently or temporarily at ambient service temperature and humidity of 68°F ± 5° F and 50% ± 10% relative humidity, for at least 48 hours prior to, during and 72 hours after the application of the flooring is required.
- B. Areas of the flooring that are subject to direct sunlight through doors or windows should have them covered using blinds, curtains, cardboard or similar for the time of the installation and 72 hours after the installation to allow the adhesive to cure. Note: These areas should be installed using wet adhesives only.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for wear.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Luxury Vinyl Tile (LVT): Printed film type, with transparent or translucent wear layer.
 - 1. Provide Basis of Design manufacturer listed in the Finish Schedule, or a standard or custom product from another manufacturer, approved prior to bid, with equivalent performance, material properties, features, general configuration, appearance, and warranty.
 - 2. Manufacturers:
 - a. **BASIS OF DESIGN:** Shaw Contract.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 4. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329; certified in accordance with UL 2824.
 - 5. Plank Size: 9 by 36 inch.
 - 6. Wear Layer Thickness: 0.020 inch.
 - 7. Total Thickness: 0.125 inch.
 - 8. Manufacturer/ Style/ Color/ Pattern: As indicated in Interior Finish Schedule.

2.02 RESILIENT BASE

- A. Resilient Base (RB#): ASTM F1861, Type TS rubber, vulcanized thermoset; top set style as indicated below.
 - 1. Manufacturers: subject to compliance with requirements, provide the Basis of Design product as indicated in Interior Finish Schedule or a comparable product, when approved prior to bid.
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. **BASIS OF DESIGN;** Johnsonite, a Tarkett Company: www.johnsonite.com.
 - c. Mannington Commercial Flooring;
 - d. Roppe Corp: www.roppe.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Height: 4 inch.
 - 3. Thickness: 0.125 inch thick.
 - 4. Top Set Style:
 - a. RB1: Straight
 - b. RB2: Coved
 - 5. Finish: Satin.

6. Length: Roll.
7. Color: As indicated on drawings.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips:
 1. Carpet to Tile: metal, see Section 09 30 00 - Tiling.
 2. Carpet to Wood: none, see Section 09 68 14 - Tile Carpeting.
 3. Resilient to Carpet: metal
 - a. Material: extruded aluminum
 - b. Configuration: trapezoid-shaped reducing strip profile with 3/8 inch wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer
 - 1) Product: "Schluter-RENO-U" manufactured by Schluter-Systems; or approved equivalent.
 - c. Finish: clear anodized, brushed/satin

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09 05 61.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.
- E. Vacuum and clean substrate. If required, only use water based sweeping compounds. Do not use any wax or oil based compounds that leave behind a residue that may interfere with the adhesive bond.
- F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.
- G. Perform mat bond tests in each major area (1 per ~1,000 sq. ft.) consisting of the proposed subfloor preparation, mitigation and leveling or smoothing products. Do not proceed with installation until all the results of the bond test are acceptable.

3.03 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's written instructions.

- B. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- F. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prevent all traffic for a minimum of 12 hours and rolling loads for 72 hours to allow the adhesive to cure.
 - 1. If required, after 12 hours protect the flooring from damage during construction operations using Masonite, plywood or a similar product, ensuring first that the flooring surface is free of all debris. Lay panels so that the edges form a butt joint and tape the joint to prevent both movement and debris entrapment underneath them. Inspect immediately before covering and after removal for final acceptance.

END OF SECTION

SECTION 09 65 66
RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interlocking, loose-laid rubber tile (AF1).

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- D. Section 09 65 00 - Resilient Flooring.

1.03 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- C. CHPS (HPPD) - High Performance Products Database.
- D. SCS (CPD) - SCS Certified Products.
- E. UL (GGG) - GREENGUARD Gold Certified Products.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.
- D. Selection Samples: Manufacturer's color charts for flooring materials specified, indicating full range of colors and textures available.
- E. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Maintenance Data: provide maintenance guidelines for resilient athletic flooring.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer must be certified ISO 9001.
 - 2. Manufactured Product must have undergone a vulcanization process; factory lamination will not be accepted as equivalent.
 - 3. Manufacturer must have a minimum of fifteen (15) years of experience in the manufacturing of prefabricated resilient athletic flooring.
- B. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. Store materials in dry and clean location until needed for installation.

- C. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.07 FIELD CONDITIONS

- A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.
- B. Recommended ambient humidity control level is between 35 to 55%
- C. Concrete subfloors, on or below grade, must be installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, as per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010in).
- D. No concrete sealers or curing compounds are applied or mixed with the subfloors
- E. Installation of the resilient athletic flooring to be carried out no sooner than the specified curing time of concrete subfloor (normal density concrete curing time is approximately 28 days for development of design strength). Refer to current version of ASTM F710.
- F. The subfloor surface must be free of any paint, wax, oil, grease, sealer, curing compound, solvent or any other contaminants that may inhibit bond. All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.
- G. Concrete to have smooth, dense finish, and be highly compacted with a tolerance of 1/8" in a 10ft radius (3.2mm in 3.05m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
- H. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed 85%, in accordance with ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with ASTM F1869 (anhydrous calcium chloride).
- I. Installation of resilient athletic flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of the resilient athletic flooring.

1.08 WARRANTY

- A. The resilient athletic flooring is warranted to be free from manufacturing defects for a period of one (1) year from the date of shipment from the Manufacturer.

PART 2 PRODUCTS

2.01 PREFORMED ATHLETIC FLOORING

- A. Manufacturers: Provide Basis of Design manufacturer listed in the Finish Schedule, or a standard or custom product from another manufacturer, approved prior to bid, with equivalent performance, material properties, features, general configuration, appearance, and warranty.
- B. Rubber Tile Flooring (AF1): Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder.
 - 1. Backing: Recycled black rubber, laminated to colored top layer.
 - 2. VOC Content: Certified as Low Emission by one of the following:
 - a. Product listing in UL (GGG).
 - b. FloorScore certified product listing in SCS (CPD).
 - c. Product listing in CHPS (HPPD).
 - 3. Thickness: Minimum 3/8 inch.

4. Size: Nominal 24 inch square.
5. Tensile Strength: Minimum 150 psi, per ASTM D412.
6. Durometer Hardness, Type A: Minimum of 65, when tested in accordance with ASTM D2240.
7. Tile Edge/Installation: Interlocking shape, loose-laid installation.
8. Interlocking Pins: Manufacturer's standard type.
9. Surface Texture: Smooth.
10. Color: As selected from manufacturer's standard range.
11. Products:
 - a. **BASIS OF DESIGN:** Tarkett; Replay; www.tarkett.com
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Transition: manufacturer's standard wedge shaped profile, color as selected by Architect from manufacturer's full range.
- B. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09 05 61.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.
- C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.
- D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Rubber Tile Flooring:
 1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
 2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
 3. Spread only enough adhesive to permit installation of materials before initial set.
 4. Fit joints and butt seams tightly; press with heavy roller to attain full adhesion.
 5. Install loose-laid tile in a staggered pattern, fit interlocking edges tightly.

3.04 CLEANING

- A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

- A. Protect finished athletic flooring from construction traffic, with 1/8" Masonite during and after the installation, to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 68 14
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered (CPT#)
- B. Walk-off carpet tile, fully adhered (WOC)
- C. Accessories

1.02 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 09 65 00 - Resilient Flooring; resilient base and flooring transitions.

1.03 REFERENCE STANDARDS

- A. CRI 104 - Standard for Installation of Commercial Carpet.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints and direction of carpet pile.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Maintenance Materials:
 - 1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

1.07 WARRANTY

- A. Manufacturer's standard 10-year commercial warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide Basis of Design manufacturer listed in the Finish Schedule, or a standard or custom product from another manufacturer, approved prior to bid, with equivalent performance, material properties, features, general configuration, appearance, and warranty.
- B. Tile Carpeting:
 - 1. **BASIS OF DESIGN:** Bentley Mills
 - 2. Interface, Inc: www.interface.com/#sle.
 - 3. Mannington Commercial.

4. Milliken & Company: www.milliken.com/#sle.
5. Mohawk Group: www.mohawkgroup.com/#sle.
6. Shaw Contract Group;
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Tile Carpeting (CPT#): Heterogenous construction of nylon textured patterned loop, manufactured in one color dye lot.
 1. Properties:
 - a. Dye Method: 100% Solution Dyed
 - b. Primary Backing: Nextep Cushion
 - c. Radiant Panel: Class 1, when tested in accordance with ASTM E 648
 - d. Smoke Density: < 450, when tested in accordance with ASTM E 662
 2. Manufacturer/ Style/ Color/ Pattern: As indicated in Finish Schedule in drawings.
 3. Size: As indicated in Finish Schedule in drawings.
 4. Install Method: As indicated in Finish Schedule in drawings.
- B. Walk-Off Carpet (WOC): Heterogenous construction of needlebond hobnail pet polyester; anti-microbial.
 1. Properties:
 - a. Dye Method: 100% Solution Dyed
 - b. Size: 24 by 24 inch
 - c. Radiant Panel: Class 1, when tested in accordance with ASTM E 648
 - d. Smoke Density: < 450, when tested in accordance with ASTM E 662
 2. Manufacturer/ Style/ Color/ Pattern: As indicated in Finish Schedule in drawings.
 3. Install Method: As indicated in Finish Schedule in drawings.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Transition Profiles for Carpet to Concrete or Rubber Tile: stainless steel; trapezoid-shaped reducing strip profile with 3/8 inch wide visible surface, integrated trapezoid-perforated anchoring leg; Schluter-Systems: RENO-U; www.schluter.com.
- C. Adhesives:
 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.
 1. Adhesive "dots" are prohibited.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09 05 61.
 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing flooring and flooring adhesives; follow the recommendations of CRI 105
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- E. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay out carpet and locate seams in accordance with shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 - 4. Provide monolithic color, pattern, and texture match within any one area.
 - 5. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other types of tiles.
 - 9. Glass.
 - 10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 08 11 13 - Hollow Metal Doors and Frames; Shop-primed items for field painting.
- C. Section 09 91 23 - Interior Painting.
- D. Section 09 96 00 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- B. SSPC-SP 1 - Solvent Cleaning.
- C. SSPC-SP 2 - Hand Tool Cleaning.
- D. SSPC-SP 6 - Commercial Blast Cleaning.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
- D. Maintenance Materials:

1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.
2. Label each container with color and type in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
 1. Benjamin Moore & Co: www.benjaminmoore.com.
 2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 3. PPG Paints: www.ppgpaints.com/#sle.
 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Colors: As indicated in Color Schedule.
1. Allow for same number of colors indicated in Finish Schedule, plus three additional samples, without additional cost to Owner.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
1. One coat of alkyd primer.
 2. Gloss: Two coats of alkyd enamel.
- B. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 2. Gloss: Two coats of alkyd enamel.
- C. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
1. Clean of protective oil with water-based cleaner/degreaser.
 2. One coat galvanize primer, or touch-up shop primer
 3. Gloss: Two coats of alkyd enamel.

2.04 EXTERIOR PRIMER PRODUCTS

- A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application. Applied to result in a dry film thickness of not less than 2.0 mils.
1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06.
 2. Diamond Vogel: CoteAll Multi-Purpose Alkyd Primer.
 3. PPG Paints; 6-208 SpeedHide Interior/Exterior Rust Inhibiting Primer.
 4. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1.
- B. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application. Applied to result in a dry film thickness of not less than 2.0 mils.
1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04.
 2. Diamond Vogel: Vers-Acyl 200 Acrylic Maintenance Primer/Finish.
 3. PPG Paints; 6-209 SpeedHide Interior/Exterior Galvanized Steel Primer.
 4. Sherwin-Williams; Galvite HS Paint B50WZ30.

2.05 EXTERIOR FINISH COAT PRODUCTS

- A. Exterior Full-Gloss Alkyd Enamel (MPI #9 or 96): Factory-formulated full-gloss alkyd enamel for exterior application. Applied to result in a dry film thickness of not less than 2.0 mil per coat.
1. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel #22:
 2. Diamond Vogel:
 3. PPG Paints; Dev-Guard Semi-Gloss Enamel. 4308.
 4. Sherwin-Williams; Industrial Enamel B-54 Series.

2.06 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed 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. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints (PT#, EPT#).
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convactor and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, and convactor and baseboard cabinets to match face panels.
 - 4. Gypsum Board: Finish all surfaces exposed to view.
 - 5. Steel Doors and Frames: Finish all surfaces exposed to view
 - a. Paint all surfaces, including top and bottom edge surfaces
 - 6. Shop-Primed Metal Items: Finish all surfaces exposed to view
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Acoustical materials, unless specifically indicated.
 - 9. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Doors and frames requiring field-painting
- C. Section 09 21 16 - Gypsum Board Assemblies: Substrate requiring paint; painting of above-ceiling firewall warning signs.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- C. SSPC-SP 1 - Solvent Cleaning.
- D. SSPC-SP 2 - Hand Tool Cleaning.

- E. SSPC-SP 6 - Commercial Blast Cleaning.
- F. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
- D. Maintenance Materials:
 - 1. See Section 01 60 00 - Product Requirements for types and amounts of products to furnish for Owner's use in maintenance of the project.
 - 2. Label each container with color and type in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
 - 1. Benjamin Moore & Co: www.benjaminmoore.com.
 - 2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 3. PPG Paints: www.ppgpaints.com.
 - 4. **BASIS OF DESIGN:** Sherwin-Williams Company: www.sherwin-williams.com.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. For interior wall and ceiling finish (all coats), anti-corrosive paints on interior ferrous metal, clear wood stains and finishes, sanding sealers, other sealers, shellac, and floor coatings-provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of Iowa
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: Match colors indicated in Interior Finish Schedule, or if not indicated, as selected from manufacturer's full range of available colors.
 - 1. Allow for same number of colors indicated in Finish Schedule, plus three additional samples, without additional cost to Owner.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 - 3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

- A. Concrete/Masonry, Opaque, Latex, 3 Coat:

1. One coat of latex primer sealer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application. Applied to result in a dry film thickness of not less than 1.5 mils.
 - a. Benjamin Moore; Super Spec Masonry Interior/Exterior Acrylic High Build Masonry Primer N068
 - b. Diamond Vogel: OmniPrep Universal Interior Primer.
 - c. PPG Paints; 4-603 Perma-Crete Acrylic Latex Alkali Resistant Primer:
 - d. Sherwin-Williams; Loxon Masonry & Concrete Primer/Sealer A24W8300.
 2. Semi-gloss: Two coats of latex enamel.
- B. Concrete Masonry Units (CMU), Opaque, Latex, 3 Coat:
1. One coat of block filler: Factory-formulated high-performance latex block fillers. Applied to result in a dry film thickness of not less than 8.0 mils.
 - a. Benjamin Moore: Super Spec Masonry Interior/Exterior Hi-Build Block Filler 0206.
 - b. Diamond Vogel: Dia-Pro Acrylic Block Filler.
 - c. PPG Paints; 6-15 SpeedHide Interior/Exterior Masonry Latex Block Filler.
 - d. Sherwin-Williams; Loxon Block Surfacer A24W00200.
 2. Semi-gloss: Two coats of latex enamel.
- C. Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer. Factory-formulated quick-drying rust-inhibitive water-based metal primer. Applied to result in a dry film thickness of not less than 2.0 mils.
 - a. Benjamin Moore; Super Spec Acrylic Metal Primer P04.
 - b. Diamond Vogel: Vers-Acryl 300 Acrylic Maintenance Primer/Finish.
 - c. PPG Paints; 90-912 Pitt Tech Int./Ext. DTM Industrial Enamel Primer.
 - d. Sherwin-Williams; DTM Acrylic Primer/Finish.
 2. Semi-gloss: Two coats of low-VOC, low-odor latex enamel; Factory-formulated semigloss acrylic-latex enamel for interior application. Applied to result in a dry film thickness of not less than 1.5 mils per coat.
 - a. Benjamin Moore; Natura 0 VOC Interior Latex Semi-Gloss Finish #514.
 - b. Diamond Vogel: Zero Plus Interior Zero VOC Latex Semi-Gloss Enamel.
 - c. PPG Paints; SpeedHide Zero Interior Semi-Gloss Enamel. 6-4510XI.
 - d. Sherwin Williams; B10 Harmony Latex Semi-Gloss.
- D. Ferrous Metals, Primed, Latex, 2 Coat - Sprayed: Exposed structure and ducts
1. Touch-up bare and damaged areas with compatible primer. Consult steel fabricator for shop primer used.
 2. Flat: Two coats of sprayed dryfall enamel. Factory-formulated self-priming flat acrylic-latex interior dryfall. Applied to result in a dry film thickness of not less than 2.5 mils per coat.
 - a. Benjamin Moore; Coronado Super Kote 5000 Dryfall Latex Flat.
 - b. Diamond Vogel: Luminance 300 Latex Dri-Mist Flat.
 - c. PPG Paints; 6-715XI (white) 6-713XI (black) Speedhide Flat Latex Dry Fog Spray Paint.
 - d. Sherwin-Williams; Pro Industrial Waterborne Acrylic Dryfall Flat B42 Series.
- E. Gypsum Board/Plaster, Latex, 3 Coat: Walls and ceilings scheduled for painting, except those to receive epoxy or dry erase coatings:
1. One coat of latex primer sealer.
 - a. Low-VOC:
 - 1) Benjamin Moore; Eco Spec WB Primer N372
 - 2) Diamond Vogel: Health-Kote Primer Interior Zero VOC Latex Primer.
 - 3) PPG Paints; Speedhide Zero Latex Primer/Sealer. 6-4900XI
 - 4) Sherwin Williams; Harmony Latex Primer B11W01500
 2. Eggshell: Two coats of low-VOC, low-odor latex enamel; Factory-formulated eggshell acrylic-latex interior enamel. Applied to result in a dry film thickness of not less than 1.6 mils per coat.

- a. Benjamin Moore; Natura® 0 VOC Interior Latex Eggshell Finish #513.
 - b. Diamond Vogel: Zero Plus Interior Zero VOC Eggshell Enamel.
 - c. PPG Paints; Speedhide Zero Interior Eggshell Enamel. 6-4310XI.
 - d. Sherwin-Williams; #B20-2600 ProMar 200 Zero VOC Interior Latex Coating.
- F. Gypsum Board/Plaster, Epoxy (EPT), 3 Coat:
 - 1. Application: walls in wet locations, all untiled walls and ceilings in restrooms, locker rooms and janitorial spaces.
 - 2. One coat of compatible primer sealer. Same as listed above for Gypsum Board.
 - 3. Semi-gloss: Two coats of low-odor, waterborne epoxy applied in a minimum of two coats at spreading rate recommended by manufacturer to achieve a total dry film thickness of 4.0 to 6.0 mils.
 - a. Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341
 - b. Carboline: Sanitile 555 Waterborne epoxy.
 - c. Diamond Vogel: Vers-E-Poxy 131 Waterborne Acrylic Epoxy.
 - d. PPG Paints: Pitt-Glaze WB 16-551.
 - e. S-W: Pro Industrial Water Based Catalyzed Epoxy, B73 Series.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces and to achieve the finishes specified whether specifically indicated or not; commercial quality
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
 3. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- J. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 2.
- K. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied. When manufacturer does not specify, allow 24 hours for interior paint and 48 hours for exterior paint to dry.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 IDENTITY PAINTING

- A. Paint firewall warning signs at rated wall construction above the ceilings as indicated in Section 09 21 16 - Gypsum Board Assemblies.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 93 00
STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of stains and transparent finishes.

1.02 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category.
- C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 6 by 6 inch in size.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Transparent Finishes:
1. Benjamin Moore;
 2. Diamond Vogel
 3. PPG Paints; www.ppgpaints.com
 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Stains:
1. Diamond Vogel
 2. PPG Paints Deft Interior Stains: www.ppgpaints.com/#sle.
 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 4. Minwax.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

- A. Finishes:
1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. Supply each finish material in quantity required to complete entire project's work from a single production run.
 4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

- A. Sponge wood with clean water and a cellulose sponge. When dry, sand with 22A sandpaper. Remove sanding dust with a clean rag dampened with tuluol.
- B. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.
1. Benjamin Moore; Benwood Paste Wood Filler No. 238.
 2. Diamond Vogel: Old Masters Woodgrain Filler.
 3. PPG Paints; as recommended by finish manufacturer.
 4. Sherwin-Williams; Sher-Wood Fast-Dry Filler.
- C. Interior Wood Stain: Factory-formulated alkyd-based penetrating wood stain for interior application applied at spreading rate recommended by manufacturer.
1. Benjamin Moore; Benwood Penetrating Stain No. 234.
 2. Diamond Vogel: Old Masters Fast Dry Stain.
 3. PPG Paints; Deft Interior Semi-Transparent Oil Stain.
 4. Sherwin-Williams; Wood Classics Interior Oil Stain A-48 Series.
- D. Clear Sanding Sealer (under waterborne polyurethane): Factory-formulated fast-drying clear wood sealer applied at spreading rate recommended by manufacturer but not less than 1.0 mils.
1. Benjamin Moore; thinned Stays Clear Acrylic Polyurethane No. 423, Satin.
 2. Diamond Vogel: Old Masters H2O Acrylic Sanding Sealer..
 3. PPG Paints; Deft WB Sanding Sealer.
 4. Sherwin-Williams; thinned Wood Classics Waterborne Polyurethane Satin, A68 Series.

- E. Interior Waterborne Clear Satin Polyurethane: Factory-formulated clear satin water-based polyurethane.
 - 1. Satin: Two coats of applied to result in a dry film thickness of 1 to 2 mils.
 - a. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.
 - b. Diamond Vogel: Old Masters Masters Armor 721
 - c. PPG Paints; Deft Satin Acrylic Clear Polyurethane.
 - d. Sherwin-Williams; Wood Classics Waterborne Polyurethane Satin, A68 Series.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of stains and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. 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. Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Wood Surfaces to Receive Opaque 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. Back prime concealed surfaces before installation.
 - 1. Paint Finish: see Section 099123 - Interior Painting.
- F. Wood Surfaces 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. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

- G. Reinstall items removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 96 00
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High Performance Coatings ("HPC").
- B. Surface preparation.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting; painting of exterior metals not scheduled for High Performance Coatings ("HPC").
- B. Section 09 91 23 - Interior Painting: painting of interior wood and metals

1.03 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- B. SSPC-SP 1 - Solvent Cleaning.
- C. SSPC-SP 2 - Hand Tool Cleaning.
- D. SSPC-SP 11 - Power Tool Cleaning to Bare Metal.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
 - 3. Color submittals will not be considered until color submittals for major materials not to be painted, such as prefinished metals, have been approved.
 - 4. Final acceptance of colors will be from samples applied on the job (see Mock-up below).

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document that applies to application on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
- F. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. High-Performance Coatings:
 - 1. PPG Paints: www.ppgpaints.com/#sle.
 - 2. Precision Coatings: www.precisioncoatingsinc.com.
 - 3. Sika Corporation: www.sikafloorusa.com.
 - 4. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
 - 5. **BASIS OF DESIGN:** Tnemec Company, Inc: www.tnemec.com/#sle.
 - 6. Substitutions: Section 01 60 00 - Product Requirements.

2.02 HIGH-PERFORMANCE COATINGS - GENERAL

- A. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.

- j. 1,2-dichlorobenzene.
- k. Diethyl phthalate.
- l. Dimethyl phthalate.
- m. Ethylbenzene.
- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

- B. Colors: as indicated in color schedule or if not indicated, as selected by Architect from manufacturer's full range.

2.03 EXTERIOR OVERCOAT

- A. Galvanized surfaces and any miscellaneous Ferrous Metals:
 - 1. Surface Prep: Power wash surface with a minimum of 3500psi water and detergent to remove all surface contaminants.
 - 2. Mastic Acrylic / Fluoropolymer Coating System:
 - a. Spot Primer for bare metal: Acrylic Mastic, Series 118 Uni Bond Mastic at 6 to 8 mils DFT.
 - b. Full Prime Coat: Acrylic Mastic, Series 118 Uni Bond Mastic at 6 to 8 mils DFT
 - c. Topcoat: Fluoropolymer Urethane, Series 1017 Fluoronar at 2.5-3.5 mils DFT

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- E. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- G. Proceed with coating application only after unacceptable conditions have been corrected.
 - 1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.

- B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Remove items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
- E. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
- F. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed 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. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and power tools according to SSPC-SP 11 "Power Tool Cleaning to Bare Metal" , and protect from corrosion until coated.
- H. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all new surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".
- B. Use applicators and techniques suited for coating and substrate indicated.
- C. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.
- D. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
- E. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- F. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- G. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- H. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

- A. Protect finished work from damage.

END OF SECTION

SECTION 10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass Markerboards (MB)

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- B. Section 06 41 00 - Architectural Wood Casework: tackable surface used in conjunction with casework.
- C. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on markerboard, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.
- D. Samples: Submit color charts for selection of color and texture of markerboard.
- E. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for chalkboard and markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Markerboards:
 - 1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
 - 2. Clarus; www.clarus.com
 - 3. **BASIS OF DESIGN:** Deko Markerboards; www.dekomarkerboards.com
 - 4. Skyline Design: www.skydesign.com
 - 5. Springboard Working Surfaces; www.springboard-us.com
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY UNITS

- A. Glass Markerboards (MB): Magnetic, optically clear, ghost-free, shatterproof, dry-erase markerboards
 - 1. Color: as indicated in Interior Finish Schedule
 - 2. Size/ Orientation: as indicated in Interior Finish Schedule; locations as indicated on drawings.
 - 3. Corners: Crown
 - 4. Mounting: "Floating" on concealed z-clips
 - 5. Accessories: Provide accessory kit containing 5-8 magnets, magnetic marker holder and eraser.

2.03 MATERIALS

- A. Glass: optically clear, tempered
 - 1. Optically clear hard coating on face, permanent opaque color on back
 - 2. Weight: 0.94 lbs SF (non-magnetic), 2.44 lbs SF (magnetic).

3. Impervious to staining from dry-erase, wet-erase and permanent markers.

2.04 ACCESSORIES

- A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- B. Mounting Brackets: Concealed.
- C. Accessory Kit (per unit): Provide accessory kit containing 8 magnets minimum, magnetic marker holder and eraser.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings, and as required for owner-provided boards.
- C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb, and at the height indicated.
- C. Butt Joints: Install with tight hairline joints.

3.04 CLEANING AND PROTECTION

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame. Protect installed markerboards from damage during construction.
- C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required room and door signs, restrooms, mechanical rooms and occupancy.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems.
- B. Section 26 51 00 - Interior Lighting: Exit signs required by code.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Shop Drawings: Indicate location plan, elevation views, materials, dimensions, and mounting details.
- D. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- E. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- G. Verification Samples: Submit samples showing colors specified.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Code-Required Flat Signs:
 - 1. Best Sign Systems, Inc: www.bestsigns.com.
 - 2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com.
 - 3. Cosco Industries (non-ADA signs): www.coscoarchitecturalsigns.com.
 - 4. FASTSIGNS: www.fastsigns.com/#sle.
 - 5. Inpro: www.inprocorp.com.
 - 6. Mohawk Sign Systems, Inc: www.mohawksign.com.
 - 7. Seton Identification Products: www.seton.com/aec.
 - 8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, excluding corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with injection molded panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Sign Height: 9 inches, unless otherwise indicated.
 - 4. Mechanical/Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings, and braille.
 - 5. Rest Rooms: Identify with standard international symbols/pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
 - 6. Quantity: As indicated on drawings.
- C. All other rooms: owner-furnished, owner-installed.
- D. Interior Directional and Informational Signs: owner-furnished, owner-installed
- E. Building Identification Signs: owner-furnished, owner-installed.

2.03 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Square.
 - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
 - 4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
- B. Characters: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - a. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.
 - 2. Character Case: Upper case only.
 - 3. Character Height: 5/8 inch minimum; based on uppercase letter "I"

Height AFF to Baseline of Character	Horizontal Viewing Distance	Minimum Character Height
40 - 70 inches	less than 6 feet 6 feet or more	5/8 inch 5/8-inch, plus 1/8 inch per foot of viewing distance beyond 6 feet
>70 - 120 inches	less than 15 feet	2-inches

	15 feet or more	2-inches, plus 1/8 inch per foot of viewing distance beyond 15 feet
More than 120 inches	less than 21 feet	3 inches
	21 feet or more	3-inches, plus 1/8 inch per foot of viewing distance beyond 6 feet

4. Character Proportions: The width of the upper case "O" shall be 55% - 110% of the character height of the upper case "I". The stroke thickness of the upper case "I" shall be 15% maximum of the character height.
 5. Character (Letter) Spacing: 1/8 inch minimum and 4 times the tactile character stroke width maximum, measured from the top surface of the tactile text, between the two closest points of adjacent characters (excluding word spaces).
 6. Line Spacing: 135% minimum and 170% maximum of the character height.
 7. Raised borders and decorative elements: 3/8 inch minimum from tactile characters.
- C. Braille:
1. Braille case: lowercase; The indication of uppercase letter(s) shall only be used for proper nouns and names, individual letters of the alphabet, initials, acronyms, or before the first word of sentences.
 2. Shape: domed or rounded shape.
 3. Location: below corresponding text; if text is multi-lined, Braille shall be placed below the entire text.
 4. Spacing: separated by 3/8 inch minimum from tactile characters, raised borders, or decorative elements.
- D. Pictograms:
1. Pictograms or symbols must be located on a field of at least 6 inches in height.
 2. Provide descriptive text located directly below the pictogram field. Braille and tactile text may not intrude into the 6 inch field.
- E. Colors
1. Background Color: As selected by Owner or Architect.
 2. Character Color: Contrasting color.
 - a. Light characters against dark backgrounds or dark characters against light backgrounds are both acceptable.

2.04 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate interior room and door signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
 1. Height: All tactile characters shall be 48 inches minimum and 60 inches maximum above the adjacent floor, measured from the baseline of the characters.
 2. Location: All room signs should be mounted adjacent to the latch side of the door, except the following:

- a. Double doors: mount sign on the inactive leaf. If both doors are active, mount sign to the right of the right hand door.
 - b. Signs can be mounted on push doors that open in and have automatic door closures without hold-open devices.
 - c. If no wall space exists on the latch side of the door, mount sign on the nearest adjacent wall.
- 3. Distance from door: Signs shall have a minimum 18 x 18 inches space on the floor, centered on the sign, beyond the arc of any door swing between the closed position and 45° open position.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 14 05
APPLIED GRAPHICS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Self-adhesive, standard and custom printed graphics, identified as "DF" (decorative film), applied to:
 - 1. Glazing

1.02 RELATED REQUIREMENTS

- A. Section 08 80 00 - Glazing: coordination

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's technical data and installation instructions.
- C. Shop Drawings:
 - 1. Submit shop drawings for verification of final graphic design. Coordinate with Architect on final design. Include plans, elevations, and large-scale dimensioned details art/graphic, layout, and location.
 - 2. Samples:
 - a. Submit full color chart/samples for review by the Architect.
 - 3. Maintenance Data: Provide user manual for Owner maintenance and repair of installed product.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.05 MOCK-UP

- A. Provide full-size mock-ups, of each piece required but on printed paper only, illustrating final graphic design and color. Prints must be color calibrated for final mock-up.
- B. Hang in final location for review by Architect and Owner.

1.06 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Use the Basis of Design as listed below, or subject to compliance with the specifications, an equivalent product from one of the following:
 - 1. Look Architectural Coatings: www.lookco.com
 - 2. **BASIS OF DESIGN** (printed): Mactac: www.mactac.com
 - 3. National Wallcovering Level Digital Wallcoverings: www.findyourlevel.com
 - 4. **BASIS OF DESIGN** (unprinted): 3M Window Film: www.3m.com/windowfilm.
 - 5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.02 FABRICATORS (PRINTERS/INSTALLERS):

- A. Evolving Edge
- B. ASI Sign Systems.
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 APPLIED GRAPHICS (FILMS)

- A. Translucent Film for glazing: Plastic film, mylar, vinyl or polyester type, surface-applied.
 - 1. Product: 3M Fasara: Glace (SH2MAGL)
 - 2. Thickness: 2.7 to 5.5 mil
 - 3. Application: Locations as indicated on drawings.
 - 4. Tint: translucent white. Translucency and/or gradation to be selected or confirmed by Architect from manufacturer's full range prior to ordering.
- B. Decorative Film for glazing: custom printed polyester film; dimensionally stable, UV stable; surface-applied as indicated in drawings.
 - 1. Product: Mactac IMAGin Bfree Dusted (JT5798MBF)
 - 2. Thickness: 2 mil thick with 1 mil acrylic adhesive and a release liner
 - 3. Latex print
 - 4. Artwork: Concept provided by Architect, art production by manufacturer

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Do not install adhesive film when ambient temperature is lower than recommended by manufacturer.
- C. Clean and prepare substrates according to manufacturer's instructions.
- D. Install neatly, with horizontal edges level.
- E. Protect from damage until Substantial Completion; repair or replace damage items.

3.02 CLEANING

- A. At completion of installation, clean soiled surfaces in accordance with manufacturer's instructions. Remove any leftover adhesive residue.
- B. Protect installed graphics from subsequent construction operations and damage until acceptance by Owner.

END OF SECTION

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner and end wall guards (CG).

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.
- B. Section 09 65 00 - Resilient Flooring; coordination with base height

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 8 inches long.
- E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide Basis of Design manufacturers listed in the Interior Finish Schedule in the Drawings, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.
- B. Corner Guards:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 3. **BASIS OF DESIGN:** Inpro: www.inprocorp.com/#sle.

4. Nystrom, Inc: www.nystrom.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted (CG):
 1. Material: Type 304 stainless steel, No. 4 finish, 16 gage, 1/16 inch thick.
 2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 3. Width of Wings: 1 inches
 4. Corner: Square.
 5. Color: As indicated in Finish Schedule.
 6. Length: One piece, full-height, from top of base to ceiling, unless noted otherwise.
- B. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
- C. See Section 06 10 00 for wood blocking for wall and corner guard anchors.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard at top of base and run to ceiling height. 1/4-inch gap maximum allowed, seal gap.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories, including but not limited to:
 - 1. Grab Bars
 - 2. Coat Hooks
 - 3. Sanitary Napkin Disposals
- B. Diaper changing stations.
- C. Utility room accessories, including but not limited to:
 - 1. Mop and Broom Holders
- D. Installation of owner-provided accessories, including:
 - 1. Toilet paper dispensers
 - 2. Paper towel dispensers
 - 3. Wall-mount soap dispensers

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including blocking.
- B. Section 08 80 00 - Glazing: Sheet mirror glass for frameless wall application.
- C. Section 09 21 16 - Gypsum Board Assemblies; substrate
- D. Section 09 30 00 - Tiling; substrate finish, coordination with joints or for recessed items.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- F. ASTM C1036 - Standard Specification for Flat Glass.
- G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site and inspect for damage.
- B. Store Maintenance Materials on site and deliver to Owner for installation when requested.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com.
 - 2. ASI - American Specialties, Inc: www.americanspecialties.com.
 - 3. Bradley Corporation: www.bradleycorp.com.
 - 4. Bobrick; www.bobrick.com
 - 5. Georgia-Pacific Professional: www.blue-connect.com.
 - 6. Hafele; www.hafele.com
 - 7. Peter Pepper.
 - 8. Substitutions: Section 01 60 00 - Product Requirements.
- B. Diaper Changing Stations:
 - 1. Bradley Corporation: www.bradleycorp.com.
 - 2. Foundations; www.foundations.com
 - 3. Koala Kare Products: www.koalabear.com.
 - 4. Substitutions: 01 60 00 - Product Requirements.
- C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide four keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Adhesive: Two component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.
- E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Owner-furnished, Contractor-installed. Double roll, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.

- B. Paper Towel Dispenser: Owner-furnished, Contractor-installed. Manual, roll paper type.
 - 1. Application: sinks not in restrooms
- C. Soap Dispenser: Owner-furnished, Contractor-installed; at porcelain sinks and non-restroom sink locations.
- D. Grab Bars: Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.
 - d. Products:
 - 1) Bobrick B-6806 Series.
 - 2) Substitutions: Section 01 60 00 - Product Requirements.
- E. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Products:
 - a. Bobrick B-270 Contura Series

2.05 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Style: Horizontal.
 - 2. Material: 18 gauge stainless steel shell with anti-microbial polyethylene body.
 - 3. Mounting: Surface.
 - 4. Features: Pneumatic cylinder, concealed hinge, ADA cam-buckle on safety strap, bag hook, liner dispenser, 5-year warranty.
 - 5. Minimum Rated Load: 400 pounds.
 - 6. Products:
 - a. Bradley Corporation: www.bradleycorp.com..
 - b. **BASIS OF DESIGN:** Foundations; 100-SSC-SM; www.foundations.com.
 - c. Koala Kare Products: www.koalabear.com..
 - d. Substitutions: 01 60 00 - Product Requirements.

2.06 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf / Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch diameter.
 - 2. Hooks: 4, 0.06 inch stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.
 - 5. Products:
 - a. Bobrick B-239 x 34
 - b. Substitutions: 01 60 00 - Product Requirements.

2.07 MISCELLANEOUS ACCESSORIES

- A. Wall Hook: stainless steel, 1.2-inch cylindrical pin "hook" on round 2-inch nominal flange with concealed mounting plate, 1-5/16-inch overall projection; satin finish
 - 1. Product: Bobrick B-542 or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

- C. Verify that field measurements are as indicated on drawings.
- D. Verify installation of blocking, reinforcing plates, and concealed anchors in walls, and ceilings.
- E. See Section 06 10 00 - Rough Carpentry for installation of blocking in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Mirrors: 40 inch, measured to bottom of mirrored surface.
 - 2. Other Accessories: As indicated on drawings.
 - 3. Mount top of grab bar 34 inches above finish floor.
 - 4. Where toilet paper dispenser mounting conflicts with a grab bar, mount above grab bar with bottom of dispenser 12 inches clear above grab bar, but no higher than 48 inches above finish floor.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

3.05 SCHEDULE

- A. Toilet Paper Dispenser: 1 per toilet fixture
- B. Paper Towel Dispenser: 1 per sink
- C. Wall-mounted Soap Dispenser: 1 per sink
- D. Grab Bars: all toilet fixtures as indicated
- E. Mop and Broom Holders: 1 per custodial room with mop sink.
- F. Infant Diaper-Changing Stations: as indicated in drawings.
- G. Sanitary Napkin Disposal: 1 per toilet
- H. Coat Hooks: 10 for field-locating.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION & SAFETY SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguisher cabinets.
- B. Key Lock Box.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 09 91 23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ADAAG - Americans with Disabilities Act Accessibility Guidelines, 2010
- B. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, and locations of individual fire extinguishers.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for factory finishes and extinguishers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers: Provided by owner.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. **BASIS OF DESIGN:** Activar Construction Products Group - JL Industries; Ambassador Series: www.activarcpg.com/#sle.
 - 2. Ansul, a Tyco Business: www.ansul.com.
 - 3. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 4. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 5. Nystrom, Inc: www.nystrom.com.
 - 6. Potter-Roemer: www.potterroemer.com.
 - 7. Pyro-Chem, a Tyco Business: www.pyrochem.com.
 - 8. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Key Lock Box:
 - 1. Knox Company: Knox-Box 3200; www.knoxbox.com
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.

1. Class: A:B:C type.
2. Size: 10 pound.

2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Construction: Non-fire rated.
 1. Formed primed steel sheet; 0.036 inch thick base metal.
- B. Cabinet Configuration: Recessed type.
 1. Size to accommodate owner-provided extinguishers and specified accessories.
 2. Rough Opening nominal dimensions of 10-1/2 inch wide by 24 inch high by 6 inch deep.
 3. Trim (fully recessed units): Flat 3/8-inch, with 1-1/2 inch wide face.
 4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.
- D. Door Glazing: none
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: as follows:
 1. Gypsum Board: primed for field paint finish
- H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Cabinet Signage: Label "FIRE EXTINGUISHER", letters in color as selected by Architect, vertical on hinge side.

2.05 KEY LOCK BOX

- A. Box: Secure, UL listed box that houses entry keys and access cards; vandal-resistant, exterior grade.
 1. Mounting: recessed
 2. Size: 5 inches wide by 4 inches tall by 3 inches deep.
 3. Capacity: 10 keys, access cards or entry items
 4. Color: Black
 5. Options: Tamper switch connects the Knox-Box to the building's alarm system for extra security

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Locate extinguishers as indicated in code plan.
- B. Install in accordance with manufacturer's instructions.
- C. Install cabinets plumb and level in wall openings, 48 inches from finished floor to highest operable part.
- D. Secure rigidly in place.
- E. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers (LKR).
- B. Locker benches.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood base construction.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking and nailers.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Samples: Submit two samples 2 by 3 inches in size showing color and finish of metal locker material.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions by field measurements before fabrication.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.
- B. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Warranty Period for All-Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers and Benches:
 - 1. Art Metal Products: www.artmetalproducts.com/#sle.
 - 2. **BASIS OF DESIGN:** Global Industries: Paramount

3. List Industries, Inc: www.listindustries.com/#sle.
4. Lyon Workspace Products: www.lyonworkspace.com/#sle.
5. Olympus Lockers; Hercules Metal Lockers; www.olympuslockers.com
6. Penco Products, Inc: www.pencoproducts.com/#sle.
7. Republic Storage Systems Co: www.republicstorage.com/#sle.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKER APPLICATIONS

- A. Lockers: Factory-assembled metal lockers, wall mounted for base indicated on drawings.
 1. Width / Depth: varies; as indicated in plans and elevations
 2. Height: 72 inches.
 3. Configuration: varies; as indicated in elevations.
 4. Fittings: Size and configuration as indicated on drawings.
 - a. Hat shelf.
 - b. Hooks: One double-prong ceiling hook, and two single-prong wall hooks.
 5. Ventilation: Louvers at top and bottom of door panel.
 6. Locking: Padlock hasps, for padlocks provided by Owner.
- B. Locker Benches: Stationary type; bench top of laminated maple; painted steel pedestals.
 1. Benchtop: 1-1/4" full finished thickness x 18" deep and furnished in lengths as shown on Drawings. All corners to be rounded and sanded. Benchtops are to be finished with one coat deep penetrating sealer and two coats of heavy body high impact hot hydraulically applied lacquer.
 2. Pedestals: 1-1/2" diameter 14 gauge steel tube welded to top and bottom 11 gauge formed flanges. Each flange to have three anchoring holes.
 3. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - a. ADA Compliant Bench: Tops are to be 48" wide x 24" deep. Four pedestals required, same as above. Overall height of bench assembly shall be 17-1/2".

2.03 METAL LOCKERS

- A. Accessibility: Comply with ICC A117.1 and ADA Standards.
 1. Handle: Handle shall have a shape that is easy to grasp with one hand and that does not require tight grasping, tight pinching or twisting of the wrist to operate.
 2. Shelf: The bottom of the locker shall have a shelf at a minimum 9" off the finished floor for side reach or 15" off the finished floor for forward reach.
 3. A decal with the international symbol of accessibility shall be applied to the face of the locker door.
- B. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
 1. Where ends or sides are exposed, provide boxed end panels
 2. Provide filler strips where indicated, securely attached to lockers.
 3. Color: To be selected by Architect.
- C. Locker Body: Formed and flanged; with steel stiffener ribs; fully welded.
 1. Body, Shelves, Filler and End panels: 16 gage, 0.060 inch.
 2. Backs: 18 gage
 3. Base: 16 gage, 0.060 inch; continuous zee base.
- D. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 1. Door Frame: 16 gage, 0.0598 inch, minimum.
- E. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
 1. Door Thickness: 14 gage, 0.0747 inch, minimum.
 2. Latch side designed to fully conceal the lock bar.

3. Doors are to be perforated.
 4. Form stainless steel recess for operating handle and locking device; recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
- F. Hinges: All doors shall be right hand side hinges.
1. Athletic Lockers: Continuous, steel with powder coat finish to match locker color.
- G. Coat Hooks: Stainless steel or zinc-plated steel.
- H. Number Plates: Provide oval shaped aluminum plates. Form three-digit numbers 3/8 inch high of block font style, in contrasting color. Attached with not less than two aluminum rivets.
- I. Locks: Locker manufacturer's standard type indicated above.
1. Multipoint Latching: Finger-lift latch control designed for use with locks indicated; positive automatic latching and pre-locking.
 - a. Latch Hooks: Equip doors with three latch hooks fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated with vinyl or nylon to prevent metal-to-metal contact, and incorporating a pre-locking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2.04 FABRICATION

- A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Accessible Lockers: Provide typical 5% minimum; fabricate as follows:
1. Locate bottom shelf no lower than 15 inches above the floor.
 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- E. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- F. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- H. Boxed End Panels: Fabricated with 1-inch-wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.
- I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.05 FINISHES

- A. All locker parts to be cleaned and coated after fabrication with a seven stage zinc iron phosphate solution to inhibit corrosion, followed by a coat of high grade custom blend powder electrostatically sprayed and baked at 350 degrees F for a minimum of 20 minutes to provide a tough durable finish.
- B. To be selected by Architect from manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, and miscellaneous panels.
 - 1. Attach end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- G. Install fittings if not factory installed.
- H. Replace components that do not operate smoothly.

3.03 ADJUSTMENT

- A. Upon completion of installation, inspect lockers and adjust as necessary for proper door and locking mechanism operation.

3.04 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION

**SECTION 10 75 00
FLAGPOLES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
- D. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.
- D. Samples: Submit two finish samples, 3 by 3 inch in size, illustrating pole material, color, and finish.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.
- B. Source Limitations: Obtain flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flagpoles:
 - 1. American Flagpole: www.americanflagpole.com.
 - 2. Concord Industries, Inc: www.concordindustries.com.
 - 3. Eder Flag Manufacturing, Inc.
 - 4. Pole-Tech Co, Inc: www.polettech.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001.
 - 1. Material: Aluminum.
 - 2. Design: Venetian entasis tapered.
 - 3. Mounting: Ground mounted type.
 - 4. Outside Butt Diameter: 7 inches.
 - 5. Outside Tip Diameter: 3.5 inches.
 - 6. Nominal Wall Thickness: 0.188 inches.
 - 7. Nominal Height: 30 ft; measured from nominal ground elevation.
 - 8. Halyard: Interior type.
- B. Performance Requirements:
 - 1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 125 miles/hr wind speed, in accordance with NAAMM FP 1001.

2.03 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper; having a tensile strength not less than 30,000 psi with a yield point of 25,000 psi.

2.04 ACCESSORIES

- A. Finial Ball: Aluminum, 6 inch diameter.
- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. American Flag: Standard design, 5 ft by 8 ft size, nylon fabric, brass grommets, hemmed edges.
- D. State Flag: Iowa design, 4 ft by 6 ft size, nylon fabric, brass grommets, hemmed edges.
- E. Cleats: 9 inch size, galvanized steel with galvanized steel fastenings, two per halyard.
- F. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous halyard and cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
 - 1. Provide one halyard and one cleat at each flagpole.
 - 2. Provide cast-metal cleat covers, finished to match flagpole, secured with cylinder locks.
 - 3. Provide halyard covers consisting of a 50-mm channel, 1500 mm long, finished to match flagpole.
- G. Halyard: 5/16 inch diameter polypropylene, braided, white.
- H. Halyard Flag Snaps: Provide two (2) stainless steel swivel snap hooks with neoprene covers.
- I. Connecting Sleeve For Multiple Section Poles: Same material as pole, precision fit for field assembly of pole, concealed fasteners.
- J. Counterbalance: plastic-coated.
- K. Foundation Tube: Galvanized corrugated-steel foundation tube, 1.6-mm- minimum nominal wall thickness. Provide with 4.8-mm steel bottom plate and support plate; 19-mm- diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
 - 1. Provide flashing collar of same material and finish as flagpole.

2.05 OPERATORS

- A. Hand Crank: Removable m-winch type.

2.06 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gage, 0.0598 inch steel, galvanized, all welded construction, depth of 42 inches.
 - 1. Provide with 3/16" (4.8 mm) steel bottom plate and steel centering wedges.

- B. Outrigger Wall Support Assembly: Plain type, of same material as flagpole with through wall anchorages, mounting plates, and brace.
- C. Lighting Ground Rod: 18 inch long copper rod, 3/4 inch diameter.

2.07 FINISHING

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.
- B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.
- C. Aluminum: Clear Anodized.
- D. Finial: Clear Anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

- A. Install flagpole and fittings in accordance with manufacturer's instructions.
- B. Fill foundation tube sleeve with concrete specified in Section 03 30 00.
- C. Install welded base assembly for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior manual roller shades (RS1).

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- C. WCMA A100.1 - Safety of Corded Window Covering Products.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
 - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- C. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Selection Samples: Include fabric samples in full range of available colors and patterns.
- E. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.
- F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.
 - 1. Manufacturer's authorized representative.

2. Factory training and demonstrated experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 1. Shade Hardware: twenty-five years.
 2. Fabric: twenty-five years.
 3. Aluminum and Steel Coatings: five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Manually Operated Roller Shades:
 1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
 2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
 3. Lutron Electronics Co., Inc: www.lutron.com/#sle.
 4. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
 5. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com/#sle.
 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROLLER SHADES

- A. General:
 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades:
 1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
 - a. Drop Position: Regular roll.
 - b. Roll Direction: Roll down, closed position is at window sill.
 - c. Mounting: Wall mounted, confirm.
 - d. Size: As indicated on drawings.
 - e. Fabric: As indicated under Shade Fabric article.
 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Stamped steel.
 - b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single clutch operator.
 3. Roller Tubes: As required for type of shade operation.
 - a. Material: Extruded aluminum, baked enamel; color from manufacturer's standards.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
 4. Hembars: Designed to maintain bottom of shade straight and flat.

- a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
- 5. Manual Operation for Interior Shades:
 - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
 - b. Drive Chain: Continuous loop beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops.
 - c. Chain Retainer:
 - 1) Chain tensioning device complying with WCMA A100.1.
- 6. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
 - 1) Color: White.
 - 2) Profile: Square.
 - b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
 - c. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting shade hardware into ceiling. Provide removable closure panel to conceal underside of brackets and roller tubes.

2.03 SHADE FABRIC

- A. Fabric for Room-Darkening Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - 1. Design Intent: to match existing if existing cannot be reused/modified.
 - 2. Manufacturers:
 - a. Lutron Electronics Co., Inc: www.lutron.com/#sle.
 - b. MechoShade Systems LLC: www.mechoshade.com/#sle.
 - c. Mermet Corporation: www.mermetusa.com/#sle.
 - d. **BASIS OF DESIGN:** Phifer, Inc; Style 7000 Blackout: www.phifer.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Material: Vinyl coated fiberglass.
 - 4. Performance Requirements:
 - a. Flammability: Pass NFPA 701 large and small tests.
 - b. Fungal Resistance: No growth when tested according to ASTM G21.
 - 5. Room-Darkening Fabric:
 - a. Openness Factor: zero (black-out).
 - b. Color: As selected by Architect from manufacturer's full range of colors.
 - 6. Fabrication:
 - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
 - b. If height of opening requires multiple panels of railroaded fabric, use manufacturer's standard sewn seams.

2.04 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
 - 2. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 1/2 inch total.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work:
 - 1. Plastic Laminate (PLAM1), as alternate.
 - 2. Quartz (QTZ1) countertops.
- B. Wall-hung counters and vanity tops.
- C. Solid-surface (SSM) window sills.
- D. Accessories, including support brackets and grommets.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry; installation of concealed blocking
- B. Section 06 41 00 - Architectural Wood Casework.
- C. Section 22 40 00 - Plumbing Fixtures: undermount or drop-in Sinks, trim and connections.

1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 01 23 00 - Alternates, for product alternates affecting this section.
 - 1. Products in this section describe both the base bid and alternate products.

1.04 REFERENCE STANDARDS

- A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
- D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.
- E. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material.
- F. MIA (DSDM) - Dimensional Stone Design Manual.
- G. NEMA LD 3 - High-Pressure Decorative Laminates.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Plastic Laminate Countertops (PLAM#): High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers:
 - 1) Formica Corporation: www.formica.com.
 - 2) Panolam Industries International, Inc Nevamar: www.nevamar.com.
 - 3) Panolam Industries International, Inc Pionite: www.pionitelaminates.com.
 - 4) Wilsonart: www.wilsonart.com.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Finish: Matte or suede, gloss rating of 5 to 20.
 - d. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
 - 2. Exposed Edge Treatment: Built up to minimum 1-1/2 inch thick.
 - a. Extruded PVC edge banding
 - 3. Back and End Splashes: Same material, same construction.
 - 4. Skirts: As indicated on drawings.
 - 5. Sinks: Stainless steel drop-in; see Plumbing
- C. Solid Surfacing (SSM): Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Application: window sills, sizes as detailed.
 - 2. Flat Sheet Thickness: 1/2 inch, minimum.
 - 3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers: subject to compliance with requirements, provide the Basis of Design product as indicated in Interior Finish Schedule or a comparable product, when approved prior to bid.
 - 1) Avonite Surfaces: www.avonitesurfaces.com.
 - 2) **BASIS OF DESIGN:** Dupont; Corian: www.corian.com.
 - 3) Formica Corporation: www.formica.com.
 - 4) Wilsonart: www.wilsonart.com.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness.
 - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - e. Color and Pattern: as indicated in Finish Schedule.
 - 4. Other Components Thickness: 1/2 inch, minimum.

- D. Natural Quartz and Resin Composite Countertops (QTZ1): Sheet or slab of natural quartz and plastic resin over continuous substrate.
1. Flat Sheet Thickness: 3 cm
 - a. Provide 2 cm at splashes.
 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers: subject to compliance with requirements, provide the Basis of Design product as indicated in Interior Finish Schedule or a comparable product, when approved prior to bid.
 - 1) Belstone/ProjectStone: EcoQuartz; www.belstoneproducts.com
 - 2) Caesarstone: www.caesarstoneus.com
 - 3) Cambria: www.cambria.com
 - 4) **BASIS OF DESIGN:** Corian Zodiac; www.corianquartz.com
 - 5) Daltile: One-Quartz;
 - 6) Substitutions: See Section 01 60 00 - Product Requirements.
 - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
 - c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - d. Finish on Exposed Surfaces: Polished.
 - 1) See Finish Schedule for additional requirements.
 - e. Color and Pattern: As indicated in Interior Finish Schedule in Drawings.
 3. Exposed Edge Treatment: Built up to thickness indicated, square eased edge.
 - a. Provide mitered waterfall edges where indicated.
 4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 5. Skirts: As indicated on drawings.
 6. Sinks: Stainless steel; see Plumbing

2.02 MATERIALS

- A. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.
- D. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; of width to match component thickness, color as scheduled, 3 mm thickness.
- E. Low-Profile Countertop Support Brackets: 1/8-inch thick steel countertop/shelf support bracket, with low profile vertical support arm and upper extension; packaged in pairs.
 1. Application: typical, except at restrooms. See 05 50 00 - Metal Fabrications for custom steel supports for restroom countertops.
 2. Capacity: 1000 lbs per pair, minimum.
 3. Depth: as indicated in drawings or as appropriate for countertop depth.
 4. Width: 1-1/2 or 2 inches
 5. Finish: as selected by Architect from manufacturer's standard range.
 6. Fasteners: 3/8" -- 16 x 3 bolt, included with bracket
 7. Product: A&M Hardware: Concealed or Hybrid Workstation Brackets; or approved equivalent.
- F. Grommets (typical): Standard flip-top plastic grommets for cut-outs, color-matched to countertop surface; color as selected by Architect.
 1. Size: 2-inch diameter
 2. Manufacturer: Doug Mockett TG or approved equivalent.

3. Furnish grommets at a ratio of 1 per 4 feet of worksurface, for field locating.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 21 05 00
BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 21 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Furnish and install a new domestic water service to the building.
 - c. Furnish and install water meter and domestic water backflow preventer as required by Code.
 - d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - e. Furnish and install gas piping system including all meter requirements.
 - f. Furnish and install water heater.
 - g. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
 - h. Furnish and install a complete sanitary sewer and vent system.
 - i. Furnish and install site sanitary sewer piping, cleanouts, and manholes.
 - 2. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install air-cooled condensing units.
 - c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - e. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - f. Furnish and install gas flues, stacks, and breechings.

- g. Furnish and install all temperature control systems.
- h. Furnish and install all fire dampers.
- 3. Fire Protection Work shall include, but is not necessarily limited to:
 - a. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
 - b. Furnish and install a complete wet pipe sprinkler system for areas noted on the drawings.
 - c. Furnish and install all items listed on the Fire Protection Material List.
 - d. Furnish all hydraulic calculations and working sprinkler drawings.
- 4. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

- 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Air Conditioning and Ventilating Contractor.
 - c. Fire Protection Contractor.
 - d. Testing, Adjusting, and Balancing Contractor.
- 2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
- 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
- 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
- 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
- 6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

- C. Mechanical Contractor's Responsibility:
1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Condensing Units.
 - b. Gas Trains.
 - c. Package Air Handling Units.
 2. Assumes all responsibility for the Temperature Control wiring.
 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
 2. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

- A. Definitions:
1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
 2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

- B. Qualifications:
1. Only products of reputable manufacturers are acceptable.
 2. All Contractors and subcontractors shall employ only workers skilled in their trades.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City of Colfax, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. Conform to all State Codes.
 3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 4. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
 5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
 6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for fire protection water service connection.
- F. Examination of Drawings:
1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

<u>Referenced Specification Section</u>	<u>Submittal Item</u>
21 05 00	Owner Training Agenda
21 13 00	Sprinkler Systems
21 13 00	Fire Protection Equipment

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g.,

voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:

- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
- b. Unstamped submittals will be rejected.
- c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
- d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
- e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**

6. Submittal Identification and Markings:

- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
- b. The Contractor shall clearly indicate the size, finish, material, etc.
- c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
- d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 21 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 21 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.7 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.

- D. Update Schedule of Values when:
 - 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Fire Seal Systems
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall

commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.13 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.

- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe wall penetrations are sealed.
 - b. Pipe identification is installed.
 - c. Branch piping in the location of sprinklers shall be dropped to the ceiling.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 - 4. Inspection report by the State Fire Marshal of the fire protection system.
 - 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div21.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Maintenance of equipment.
 3. Start-up procedures for all major equipment.
 4. Description of emergency system operation.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 1. Sprinkler System(s) - 2 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

- A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of fire protection drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the fire protection systems.
- B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- C. Before completion of the project, a set of reproducible fire protection drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- D. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- E. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.8 PAINTING

- A. This Contractor shall paint the following items:
 - 1. All piping in mechanical room
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Color of paint shall be as follows:
 - a. All piping in mechanical room:
 - 1) Fire Protection: Red pipe/white letters

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.11 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 2. Request that the Owner designate an IAQ representative.
 3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
 6. Request copies of and follow all of the Owner's IAQ and infection control policies.
 7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
 8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
 9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. Fire protection system operational.
3. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 21 05 03
THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials.
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2015 International Building Code

1.4 SUBMITTALS

- A. Submit under provisions of Section 21 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following

manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated

F Rating = Floor/Wall Rating

T Rating = Floor/Wall Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated

F Rating = Wall Rating

T Rating = 0

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated

F Rating = Wall/Floor Rating

T Rating (Floors) = Floor Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 21 05 29
FIRE SUPPRESSION SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE

- A. Support Sprinkler Piping in conformance with NFPA 13.

1.3 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- D. NFPA 13 - Standard for the Installation of Sprinkler Systems.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 21 05 00.

PART 2 - PRODUCTS

2.1 HANGER RODS

- A. Hanger rods for single rod hangers supporting steel, copper, and CPVC piping shall conform to the following:

<u>Pipe Size</u>	<u>Rod Size</u>
4" and smaller	3/8"
5", 6", 8"	1/2"
10" and 12"	5/8"

- B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE HANGERS AND SUPPORTS

- A. General:
 - 1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, 69, 89, and 127 (where applicable).
- B. Vertical Supports:
 - 1. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.

Acceptable Products:

Anvil - Fig. CT121

Cooper/B-Line - Fig. B3373CT

Erico - Model 510

Nibco/Tolco - Fig. 82

2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs.
3. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.

2. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type:

Service: Bare Metal Pipe

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
Anvil	Fig. 260	Fig. CT65
Cooper/B-Line	Fig. 3100	Fig. B3104CT
Erico	Model 400	Model 402
Nibco/Tolco	Fig. 1	Fig. 81

b. Adjustable Swivel Ring Type:

Service: Bare Metal Pipe - 4 inches and Smaller

Acceptable Products:	Bare Steel Pipe	Bare Copper Pipe
Anvil	Fig. 69	Fig. CT69
Cooper/B-Line	Fig. B3170NF	Fig. B170CT
Erico	Model FCN	
Nibco/Tolco	Fig. 200	Fig. 202

3. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
4. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
5. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

6. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type:

Service: Bare Metal Pipe

- 1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
- 2) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

Acceptable Products:	Bare Steel, Plastic	Bare Copper Pipe
	or Insulated Pipe	

Unistrut	Fig. P1100 or P2500

Cooper/B-Line	Fig. B2000 or B2400	Fig. BVT

Nibco/Tolco	Fig. A-14 or 2STR

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps:

- 1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):

Acceptable Products:

Anvil	Fig. 92

Cooper/B-Line	Fig. B3033/B3034

Erico	Model 300

Nibco/Tolco	68

- 2) Scissor Type Beam Clamps (for use with bar-joists and wide flange):

Acceptable Products:

Anvil	Fig. 228, 292

Cooper/B-Line	Fig. B3054

Erico	Model 360

Nibco/Tolco	Fig. 329

b. Concrete:

- 1) Concrete Inserts, Single Rod Galvanized:

Acceptable Products:

Anvil	Fig. 282

Cooper/B-Line	Fig. B3014

Erico	Model 355

Nibco/Tolco	Fig. 310

- 2) Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:

Unistrut Corp	P3200 Series
Cooper/B-Line	Fig. B22-J
Erico	CONCT

- 3) Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

- 4) Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

c. Steel Structure Welding:

- 1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and for protecting walls and ceilings from being damaged by smoke.

2.3 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.4 PIPE SLEEVES AND LINTELS

- A. Each Contractor shall provide pipe sleeves and lintels for all openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Engineer's design.
- E. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

- F. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.5 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

2.6 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.7 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.8 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 FIRE SUPPRESSION SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

- C. Pipe Requirements:
1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
 2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 4. Piping shall not introduce strains or distortion to connected equipment.
 5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- G. Spacing of hangers shall in no case exceed the following:

	<u>Pipe Material</u>	<u>Maximum Spacing</u>
1.	Steel (All steel pipe unless otherwise noted):	
	1-1/4" & under	12'-0"
	1-1/2" & larger	15'-0"
2.	Steel (Schedule 40 lightweight alternative):	
	3" & under	12'-0"

	<u>Pipe Material</u>	<u>Maximum Spacing</u>
3.	Hard Drawn Copper:	
	1" & under	8'-0"
	1-1/4" to 1-1/2"	10'-0"
	2" to 3"	12'-0"
	3-1/2" & larger	15'-0"
H.	Installation of hangers shall conform to MSS SP-58, 69, 89, and applicable NFPA standards.	

END OF SECTION

SECTION 21 13 00
FIRE PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe, Fittings, Valves, and Connections for Fire Protection System.
- B. Wet-Pipe Sprinkler System.

1.2 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME Code
- B. Equipment and Components: Bear UL label or marking.
- C. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.

1.3 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt-Welding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- G. ANSI/ASME B16.25 - Butt-Welding Ends.
- H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- I. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
- J. ANSI/ASTM A47 - Malleable Iron Castings.
- K. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- L. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- M. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
- N. ASME - Boiler and Pressure Vessel Code - Section IX, Welding and Brazing Requirements.
- O. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- P. AWS A5.8 - Brazing Filler Metal.
- Q. AWS B2.2 - Standard for Brazing Procedure and Performance Qualification.
- R. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- S. IBC - International Building Code.
- T. MSS SP-73 - Brazing Joints for Wrought and Cast Copper Alloy Solder Joint and Pressure Fittings.
- U. NFPA 101 - Life Safety Code,
- V. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- W. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- X. UL - Underwriter's Laboratory Fire Protection Equipment Directory.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 21 05 00. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.
- B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.
- C. Submit detailed working drawings and obtain review of them in the following order:
 - 1. Engineer/Architect/State Fire Marshal/Authority Having Jurisdiction
 - 2. Owner's Insurance Company
 - 3. Architect/EngineerBegin construction after all approvals are received.
- D. Working drawings shall include piping and sprinkler layout, sprinkler types and ratings, sections and elevations at critical points. Show coordination with lighting, ductwork, and diffusers, and indicate basic flow and hydraulic design information, including main location and date that the test was taken.
- E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- F. Provide the Owner with one copy of NFPA 25. *Standard for the Inspection Testing and Maintenance of Water-based Fire Protection Systems*.
- G. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

1.5 EXTRA STOCK

- A. Provide metal storage cabinet, wrenches for each sprinkler type, and extra sprinklers per NFPA 13 and applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store valves and sprinklers in shipping containers, with labels in place.
- B. Provide temporary protective coating on iron and steel valves.
- C. Maintain temporary end caps and closures in place until installation.

1.7 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.8 SYSTEM DESCRIPTION

- A. Contractor shall design and install the following water-based fire protection systems for the areas noted on the contract documents:
 - 1. Wet pipe sprinkler system(s)
- B. Sprinkler systems shall be designed and installed according to the following standard(s):
 - 1. NFPA 13 – Standard for the Installation of Sprinkler Systems
- C. System design and installation shall include all requirements by the Authority Having Jurisdiction, local and state building codes, and Owner's insurance company in addition to the previously listed design standard(s). Those requirements shall take precedence over the contract documents in the case of discrepancies.
- D. Systems shall be hydraulically calculated in accordance with the applicable design standard(s). Contractor is responsible for final pipe sizing based on results from hydraulic

calculations. Pipe sizing shown on drawings for service entrance and main risers is preliminary and for coordination purposes only.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturers' operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

1.10 JOB CONDITIONS

- A. Fire Protection Contractor shall determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 18 months.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - WET PIPE SPRINKLER SYSTEMS

- A. Piping – 2" and Under:
 - 1. Design Pressure: 175 psig
 - 2. Pipe: Schedule 40, black steel , ANSI/ASTM A53, ASTM A795, UL/FM. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
 - 3. Joints: Threaded, or flanged.
 - 4. Fittings:
 - a. Threaded:
 - 1) Cast iron, Class 125, black, UL/FM, ASME A153.
 - 2) Malleable iron, Class 150, black, UL/FM, , ASME A153.
 - 3) Ductile iron, Class 150, black, UL/FM, ASME A153.
 - b. Flanged:
 - 1) Cast iron, Class 125, black, UL/FM, ASME A153.
 - 5. Unions: Class 150 malleable iron, ANSI B16.39, ground joint with copper or copper alloy-to-iron seat.
- B. Piping – 2-1/2" and Above:
 - 1. Design Pressure: 175 psig
 - 2. Pipe: Schedule 40, black steel ANSI/ASTM A53, ASTM A795, UL/FM. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
 - a. Joints: Grooved or flanged.
 - b. Fittings:
 - 1) Grooved:
 - a) Ductile iron housing ASTM A-536, Grade 65-45-12, UL/FM, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40°F to 150°F. Carbon steel bolts and nuts.
 - 2) Flanged:
 - a) Cast iron, Class 125, black, UL/FM, ASME A153.

2.2 VALVE OPERATORS

- A. Provide handwheels for gate valves. Provide gear operators for butterfly valves.

2.3 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe.

2.4 BACKFLOW PREVENTERS

- A. Provide backflow preventers as required by code and as specified on the drawings.

2.5 EQUIPMENT

- A. Equipment shall be as scheduled on the drawings.

2.6 PIPE LABELING AND IDENTIFICATION

- A. All pipe shall be marked along its length by the manufacturer in such a way as to properly identify the type of pipe.
- B. The manufacturer pipe marking shall be visible on every piece of pipe over 2 ft. long.
- C. Manufacturer pipe identification shall include the manufacturer's name, model designation, and/or schedule.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING

- A. General Installation Requirements:
 - 1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.
 - 2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.
 - 3. Die cut screw joints with full cut standard taper pipe threads.
 - 4. Coat threads with pipe joint compound or wrap with Teflon tape.
 - 5. Locate piping to minimize obstruction of other work.
 - 6. Route piping in concealed spaces above finished ceiling.
 - 7. Use full and double lengths of pipe wherever possible.
 - 8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.
 - 9. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
 - 10. Comply with manufacturer's installation instructions.
- B. Steel Piping:
 - 1. In steel piping, main sized saddle branch connections or direct connection of branches to main is permitted if main is one pipe size larger than the branch for up to 6" mains and if main is two pipe sizes larger than branch for 8" and larger mains. Do not project branch pipes into main pipes.
- C. Wall/Floor Penetration:
 - 1. Provide sleeves when penetrating floors and walls.
 - 2. Seal pipes passing through exterior walls with a wall seal per Section 21 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe. Sleeves through floors shall extend minimum 1.5" above finished floor.
 - 3. Fire seal all pipe and sleeve penetrations (both wall and floor) to maintain fire separation required without restraining pipe.
- D. Installation Requirements in Electrical Rooms:
 - 1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

- E. Hangers and Supports:
 - 1. Provide hangers and supports as required by NFPA 13 and UL, with the following exceptions:
 - a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.
 - b. Do not install fasteners to carry the load in tension, unless absolutely necessary.
- F. Exposed Piping:
 - 1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.
 - 2. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

3.2 INSTALLATION - VALVES

- A. Install gate valves with stems upright or horizontal, not inverted.
- B. Backflow Preventer:
 - 1. Units shall be field tested and tagged in accordance with manufacturer's instructions by a certified tester before initial operation.
 - 2. Install unit between 12" and 60" above finish floor.
 - 3. Provide monitor switches on all shutoff valves.
- C. Shutoff Valve:
 - 1. Provide drain valves at main shutoff valves, low points of piping and apparatus.
 - 2. Provide monitor switches on all shutoff valves.

3.3 INSTALLATION - EQUIPMENT

- A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.
- B. Fire Department Connection:
 - 1. Locate fire department connection in an accessible location as approved by the local fire department with sufficient clearance from walls, obstructions, and adjacent Siamese connectors to allow full swing of fire department wrench handle.
- C. Test Valves:
 - 1. Install test valves where required. Pipe to outdoors or drain. Test connection shall have flow equivalent to the smallest K-factor sprinkler.
- D. Sprinklers:
 - 1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.
 - 2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
 - 3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.
 - 4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.4 SYSTEMS CLEANING AND TESTING

- A. General Requirement:
 - 1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.

B. Interior Piping:

1. Verify adequate water flow at the inspector's test connection.
2. Flush all interior piping to remove scale and other foreign material before placing system into service.
3. Hydrostatically test the entire interior piping system at a minimum of 200 psig or 50 psig more than the normal system working pressure for systems subjected to pressures more than 150 psig. Maintain test pressure for 2 hours without loss of pressure.

END OF SECTION

SECTION 22 05 00
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Furnish and install a new domestic water service to the building.
 - c. Furnish and install water meter and domestic water backflow preventer as required by Code.
 - d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - e. Furnish and install gas piping system including all meter requirements.
 - f. Furnish and install water heater.
 - g. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
 - h. Furnish and install a complete sanitary sewer and vent system.
 - i. Furnish and install site sanitary sewer piping, cleanouts, and manholes.
 - 2. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install air-cooled condensing units.
 - c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - e. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - f. Furnish and install gas flues, stacks, and breechings.

- g. Furnish and install all temperature control systems.
- h. Furnish and install all fire dampers.
- 3. Fire Protection Work shall include, but is not necessarily limited to:
 - a. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
 - b. Furnish and install a complete wet pipe sprinkler system for areas noted on the drawings.
 - c. Furnish and install all items listed on the Fire Protection Material List.
 - d. Furnish all hydraulic calculations and working sprinkler drawings.
- 4. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

- 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Air Conditioning and Ventilating Contractor.
 - c. Fire Protection Contractor.
 - d. Testing, Adjusting, and Balancing Contractor.
- 2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
- 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
- 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
- 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
- 6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Condensing Units.
 - b. Gas Trains.
 - c. Package Air Handling Units.
2. Assumes all responsibility for the Temperature Control wiring.
3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.

2. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Colfax, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for service connections, such as sewer, and water. and gas.
 4. Make application for and pay for all meters and metering systems required by the utility company.
- F. Examination of Drawings:
1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
 3. Scaling of the drawings is not sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
 6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
 7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
 8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

- G. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.
- H. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
 5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
 6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
 7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
 8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.5 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

<u>Referenced Specification Section</u>	<u>Submittal Item</u>
22 05 03	Fire Seal Systems
22 09 00	Instrumentation
22 10 30	Plumbing Specialties
22 11 23	Domestic Water Pumps
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number

- f. Notations of deviations from the contract documents
 - g. Other pertinent data
- 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
- 3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.

- 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
- 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 22 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 22 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.6 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 1. Indicated by Architect/Engineer.
 2. Change of subcontractor or supplier occurs.
 3. Change of product or equipment occurs.

1.7 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 1. Fire Seal Systems
 2. Mixing Valves

- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.

- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
 - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
 - 2. The Contractor shall do all excavating, filling, backfilling and compacting associated with his/her work.
- B. Excavation:
 - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
 - 2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
 - 3. Trim bottom and sides of excavations to grades required for foundations.
 - 4. Protect excavations against frost and freezing.
 - 5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.

6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
 7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
 8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.
- C. Dewatering:
1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
 2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. No rubbish or waste material is permitted for fill or backfill.
 2. Provide all necessary sand and/or CA6 for backfilling.
 3. Dispose of the excess excavated earth as directed.
 4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials and stones greater than 4 inches in diameter. Water shall not be permitted to rise in unbackfilled trenches. No material shall be used for backfilling that contains frozen earth, debris, or earth with a high void content.
 5. Backfill all trenches and excavations immediately after installing pipes or removal of forms, unless other protection is provided.
 6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.
 7. Lay all piping on a compacted bed of CA6 at least 3 inches deep. Backfill around pipes with CA6, 6 inch layers, and compact each layer.
 8. Use sand or CA6 for backfill up to grade for all piping under slabs or paved areas. All other piping shall have sand or CA6 backfill to 6 inches above the top of the pipe.
 9. Place all backfill above the sand/CA6 in uniform layers not exceeding 6 inches deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
 10. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T-99 or ASTM D-698 test.
- F. Surface Restoration:
1. Where trenches are cut through graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.

2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up drawings and specifications.
 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear

the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.

4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div22.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Maintenance of equipment.
 3. Start-up procedures for all major equipment.
 4. Explanation of seasonal system changes.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- G. Operating Instructions:
 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.

2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:
Contractor shall maintain at the job site a separate and complete set of plumbing drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the plumbing systems.
- B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- C. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

- A. This Contractor shall paint the following items:
 - 1. All piping in mechanical room
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- H. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

3.10 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 22 05 03
THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials.
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2015 International Building Code

1.4 SUBMITTALS

- A. Submit under provisions of Section 22 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following

manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated

F Rating = Floor/Wall Rating

T Rating = Floor/Wall Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated

F Rating = Wall Rating

T Rating = 0

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated

F Rating = Wall/Floor Rating

T Rating (Floors) = Floor Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 22 05 13
MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single Phase Electric Motors.

1.2 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- D. ANSI/NEMA MG 1 - Motors and Generators.
- E. ANSI/NFPA 70 - National Electrical Code.
- F. Energy Independence and Act of 2007.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00. Include nominal efficiency and power factor for all premium efficiency motors. Efficiencies must meet or exceed the nominal energy efficiency levels presented below.
- B. Submit shop drawings for all three phase motors.
- C. Submit motor data with equipment when motor is installed by the manufacturer at the factory.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

PART 2 - PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- G. Each contractor shall set all motors furnished by him.
- H. All motors shall have a minimum service factor of 1.15.
- I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- K. Motors for pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control.

2.2 MOTOR DRIVEN EQUIPMENT

- A. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
- B. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

END OF SECTION

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 22.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.2 MATERIALS

- A. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<u>OD of Pipe or insulation</u>	<u>Marker Length</u>	<u>Size of Letters</u>
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4
8" to 10"	24"	2-1/2"

Plastic tags may be used for outside diameters under 3/4".

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
- G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- H. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferrous metal detectors and bold lettering identifying buried item.
- I. Tracer Wire:
1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
 2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
 3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Valves:
 - 1. All valves (except shutoff valves at equipment) shall have numbered tags.
 - 2. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
 - 3. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
 - 4. Number all tags and show the service of the pipe.
 - 5. Provide two sets of laminated 8-1/2" x 11" copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
- D. Pipe Markers:
 - 1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 - 2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
 - 3. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.
 - 4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.
- E. Equipment:
 - 1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
 - 2. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

Pipe Service	Lettering Color	Background Color
CONDENSATE DRAIN	Black	Yellow
DOMESTIC COLD WATER	White	Green
DOMESTIC HOT WATER - 115°F	Black	Yellow
DOMESTIC HOT WATER - 140°F	Black	Yellow
DOMESTIC HOT WATER CIRCULATING - 115°F	Black	Yellow
DOMESTIC HOT WATER CIRCULATING - 140°F	Black	Yellow
SANITARY SEWER	Black	Yellow
VENT	Black	Yellow
NATURAL GAS	Black	Yellow
All Underground Pipes	Varies	Varies
Tracer Wire - Water Pipe Lines	---	Blue
Tracer Wire - Natural Gas Pipe Lines	---	Yellow
Tracer Wire - All other buried types	---	Green

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with five years minimum experience.
- B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- C. ANSI/ASTM C534 - Elastomeric Foam Insulation.
- D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
- E. ASTM E84 - Surface Burning Characteristics of Building Materials.
- F. NFPA 255 - Surface Burning Characteristics of Building Materials.
- G. UL 723 - Surface Burning Characteristics of Building Materials.
- H. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 22 05 00. Include product description, list of materials and thickness for each service, and locations.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).
- B. Type B: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.

2.2 VAPOR BARRIER JACKETS

- A. Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

2.3 JACKET COVERINGS

- A. Plastic Jackets and Fitting Covers: High impact, glossy white, 0.020" thick, self-extinguishing plastic. Suitable for use indoors or outdoors with ultraviolet inhibitors. Suitable for -40°F to 150°F. 25/50 maximum flame spread/smoke developed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.
2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
3. On all insulated piping, provide at each support an insulation insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a 180° cylindrical segment the same length as metal shields. Inserts shall be a cellular glass (for all temperature ranges) or molded hydrous calcium silicate (for pipe with operating temperatures above 70°F), with a minimum compressive strength of 50 psi. Factory fabricated inserts may be used. Rectangular blocks, plugs, or wood material are not acceptable. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.
4. Neatly finish insulation at supports, protrusions, and interruptions.
5. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.
6. Shields shall be at least the following lengths and gauges:

	Pipe Size	Shield Size
a.	1/2" to 3-1/2"	12" long x 18 gauge
b.	4"	12" long x 16 gauge
c.	5" to 6"	18" long x 16 gauge
d.	8" to 14"	24" long x 14 gauge
7. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has passed ASTM E84 and/or NFPA 255 testing with a rating of 25/50 or below.
8. On 1" and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
2. On piping operating below 60°F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.

3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.
- C. Insulated Piping Operating Between 60°F and 140°F:
 1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.
- D. Insulated Piping Operating Above 140°F:
 1. Insulate fittings, valves, flanges, and strainers.
 2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.
- E. Exposed Piping:
 1. Locate and cover seams in least visible locations.
 2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
 3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

3.3 INSULATION

- A. Type A Insulation:
 1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
 2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
 3. Apply insulation with laps on top of pipe.
 4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F, seal fitting covers with vapor retarder mastic in addition to tape.
- B. Type B Insulation:
 1. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
 2. Self-seal insulation may be used on pipes operating below 170°F.

3.4 JACKET COVER INSTALLATION

- A. Plastic Covering:
 1. Provide vapor barrier as specified for insulation type. Cover with plastic jacket covering. Position seams to shed water.
 2. Solvent weld all joints with manufacturer recommended cement.
 3. Overlap all laps and butt joints 1-1/2" minimum. Repair any loose ends that do not seal securely. Solvent weld all fitting covers in the same manner. Final installation shall be watertight.

4. Use plastic insulation covering on all exposed pipes including, but not limited to:
 - a. All exposed piping in areas noted on drawings.
 - b. All exposed piping below 8'-0" above floor.
 - c. All piping in mechanical rooms and/or tunnels that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)
5. Elastomeric piping insulation may have two coats of latex paint instead of plastic jacket.

3.5 SCHEDULE

- A. Refer to attached insulation schedule.

END OF SECTION

PLUMBING For Use With: ASHRAE 2016												
Piping System	Insulation Thickness per Pipe Size											
	< 1"			1" to < 1-1/2"			1-1/2" to < 4"			4" to < 8"		
Domestic Hot Water & Circulating - Potable and Non-Potable - up to 140°F	A 1"	B 1"	E 1" *	A 1"	B 1"	E 1" *	A 1-1/2"	B 1-1/2" +	E 1" *	A 1-1/2"	B 1-1/2" +	E 1" *
Domestic Hot Water & Circulating - Potable and Non-Potable - over 140°F	A 1-1/2"	E 1-1/2" *		A 1-1/2"	E 1-1/2" *		A 2"	E 1-1/2" *		A 2"	E 1-1/2" *	
Domestic Tempered Water & Circulating - Potable and Non-Potable (60°F-104°F)	A 1"	B 1"	E 3/4" *	A 1"	B 1"	E 3/4" *	A 1"	B 1"	E 3/4" *	A 1"	B 1"	E 3/4" *
Domestic Cold Water - Potable and Non-Potable	A 1"	B 1"	E 3/4" *	A 1"	B 1"	E 3/4" *	A 1"	B 1"	E 3/4" *	A 1"	B 1"	E 3/4" *
Plumbing Vents Within 10' from Roof Penetration	A 1/2"	B 1/2"		A 1/2"	B 1/2"		A 1/2"	B 1/2"		A 1/2"	B 1/2"	
Insulation Inserts at Hangers	Type C or D or E* - Match Pipe Insulation Thickness											
SPARE												
SPARE												
SPARE												
SPARE												

KEY NOTES FOR CONTRACTORS: * Type E not allowed in Return Air Plenum (not 25/50 rated)

+ Type B < 1" thickness shall be installed using multiple layers of 3/4" or 1".

**SECTION 22 10 00
PLUMBING PIPING**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Domestic Water Piping System.
- D. Sanitary Drainage and Vent Piping System.
- E. Dielectric Connections.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

- A. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- B. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- F. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- G. ANSI/ASTM B32 - Solder Metal.
- H. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
- I. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
- J. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- K. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- L. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.
- M. ASME - Boiler and Pressure Vessel Code.
- N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- O. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
- P. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- Q. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
- R. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.

- S. ASTM B88 - Seamless Copper Water Tube.
- T. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- U. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- V. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- W. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- X. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- Y. ASTM D2665 - PVC DWV Pipe & Fittings.
- Z. ASTM D3033 - Type PSP (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- AA. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- BB. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
- CC. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- DD. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- EE. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
- FF. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- GG. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- HH. AWS A5.8 - Brazed Filler Metal.
- II. AWWA C651 - Disinfecting Water Mains.
- JJ. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- KK. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- LL. FM 1680 - Couplings Used in Hubless Cast Iron Systems.
- MM. NFPA 24 - Private Fire Service Mains and Their Appurtenances.
- NN. NFPA 54 - National Fuel Gas Code.
- OO. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases.
- PP. NSF - National Sanitation Foundation

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 COLD WATER - POTABLE AND NON-POTABLE

HOT WATER - POTABLE AND NON-POTABLE

TEMPERED WATER - POTABLE AND NON-POTABLE

- A. Design Pressure: 175 psi.
Maximum Design Temperature: 200°F.

- B. Piping - All Sizes:
1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
 2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 3. Fittings: Wrought copper solder joint, ANSI B16.22.
- C. Piping - 4" and Under (Contractor's Option):
1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
 2. Joints: Mechanical press connection.
 3. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.
 4. Acceptable Manufacturers: Viega ProPress, Elkhart Xpress, Nibco Press System Fittings and Valves, Mueller Streamline PRS.
- D. Piping - 2-1/2" through 8" (Contractor's Option):
1. Tubing: Type L hard drawn seamless copper tube, ASTM B88, roll grooved per mechanical coupling manufacturers specifications.
 2. Joints: Mechanically coupled grooved type.
 3. Mechanical Couplings: Ductile iron, ASTM A-536, (Grade 65-45-12), rigid grooved type, coated with non-toxic, no-lead paint, bolts and hex nuts zinc electroplated plated, ASTM B-633
 4. Gaskets: Molded pressure responsive design, EPDM Grade E, ASTM D-2000, suitable for domestic water with temperatures ranging from 32°F to 230°F.
 5. Fittings: Copper, ASTM B-75 and ANSI B-16.22, Full flow wrought copper, manufactured by mechanical coupling manufacturer
 6. Flanges: Grooved end type, Ductile iron, ASTM A-536, (Grade 65-45-12), Flange shall conform to ANSI Class 125 cast iron and Class 150 steel flange bolt hole pattern, coated with non-toxic, no-lead paint, bolts and hex nuts zinc electroplated plated, ASTM B-633.
 7. Acceptable Manufacturers: Gruvlok, Victaulic, Grinnell.
- E. Shutoff Valves:
1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
 2. Butterfly Valves:
 - a. BF-1:
 - 1) 2-1/2" thru 6", 175 psi CWP, elastomers rated for 20°F to 250°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10 position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Stockham LD712-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.
 - 2) Mechanically coupled grooved end valves are acceptable if they have the features listed above. Victaulic #608, Nibco GD4765.

3. Ball Valves:

a. BA-1:

- 1) 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

NOTES:

- a) Provide extended shaft for all valves in insulated piping.
- b) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

F. Throttling/Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, throttling valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. Globe Valves:
 - a. GL-1: 2" and under, 150# saturated steam, 300# CWP, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #3095, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, Nibco T-235Y.
 - b. GL-2: 2-1/2" thru 10", 125# steam @ 353°F, 200# CWP @ 150°F, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #8906F, Milwaukee #F2981, Watts #F-501, Nibco F-718B.

G. Check Valves:

1. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.

H. Strainers:

1. For pipe systems where mechanical press connections are allowed, strainers with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.
3. ST-7: 2-1/2" thru 8", bronze body, flanged ends, flanged cover, 150# steam, 225# CWP. Mueller Steam Specialty Co. #851.

2.2 SERVICE WATER - POTABLE

- A. Design Pressure: 200 psi.
Maximum Design Temperature: 150°F.
- B. Piping:
 - 1. Pipe: Ductile iron pressure water pipe, ANSI/AWWA C151/A21.51, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4.
 - 2. Fittings: Ductile iron, ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4, push-on joints.
 - 3. Joint: Push-on joint with rubber gasket, ANSI/AWWA C111/A21.11.
- C. Piping:
 - 1. Pipe: Ductile iron pressure water pipe, ANSI/AWWA C151/A21.51, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4.
 - 2. Fittings: Ductile iron, ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.53, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4, mechanical joints.
 - 3. Joint: Mechanical joint with glands and gaskets and steel bolts. ANSI/AWWAC111/A21.11.
- D. Shutoff Valves:
 - 1. Gate Valves:
 - a. GA-1: 2" and under, 150# steam @ 406°F, 300# CWP @ 150°F, screwed, bronze, rising stem, screwed bonnet. Crane #431, Hammond #IB641, Stockham #B122, Walworth #56, Milwaukee #1150, Watts #B-3210, Nibco T-131.
 - b. GA-2: 2-1/2" thru 12", 125 psi S @ 353°F, 200 psi CWP @ 150°F, flanged, iron body, bronze mounted, OS&Y. Crane #465-1/2, Hammond, Stockham #G623, Walworth, Milwaukee #F2885, Watts #F-503, Nibco F-617-0.
 - 2. Ball Valves:
 - a. BA-11: 2" and under, 300 psig water, standard port, screwed or compression. Bronze body and ball of a copper alloy containing less than 15% zinc, chrome plated, Teflon coated, or stainless steel ball. Teflon or Buna-N seats. One piece "T" style cap and stem. A.Y. McDonald 6100 Series, Mueller 300 Series.
 - b. BA-12: 2" and under, 300 psig water, standard port, screwed or compression. Bronze body and ball of a copper alloy containing less than 15% zinc, chrome plated, Teflon coated, or stainless steel ball. Teflon or Buna-N seats. One piece "T" style cap and stem. Minneapolis Pattern threaded top. A.Y. McDonald 6100 Series, Mueller 300 Series.

2.3 COMBINATION WATER AND FIRE PROTECTION SERVICE FIRE PROTECTION SERVICE

- A. Design Pressure: 200 psi.
Maximum Design Temperature: 150°F.
 - 1. Pipe: Ductile iron pressure water pipe, ANSI/AWWA C151/A21.51, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4.

2. Fittings: Ductile iron, ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.53, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4, push-on joints.
 3. Joint: Push-on joint with rubber gasket, ANSI/AWWA C111/A21.11.
- B. Piping:
1. Pipe: Ductile iron pressure water pipe, ANSI/AWWA C151/A21.51, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4.
 2. Fittings: Ductile iron, ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.53, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4, mechanical joints.
 3. Joint: Mechanical joint with glands and gaskets and steel bolts. ANSI/AWWAC111/A21.11.
- C. PVC Pressure Pipe (Outside Building-Underground):
1. Pipe: PVC pressure pipe, Class 150 ANSI/AWWA C900 approved, bell and spigot ends.
 2. Joints: Push-On Type, elastomeric ring seal per ASTM F477, bevel spigot ends.
 3. Fittings: Cast iron bell and spigot type, 150 psig rating, corrosion protective coating outside, cement mortar lined inside, ANSI A21.10 or A21.11.
- D. Strainers:
1. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.
 2. ST-7: 2-1/2" thru 8", bronze body, flanged ends, flanged cover, 150# steam, 225# CWP. Mueller Steam Specialty Co. #851.

2.4 SANITARY DRAINAGE (ABOVE GROUND)
SANITARY INDIRECT DRAINAGE (ABOVE GROUND)
SANITARY VENT (ABOVE GROUND)
CONDENSATE DRAINAGE (ABOVE GROUND)

- A. Design Pressure: Gravity
Maximum Design Temperature: 180°F
- B. Piping - All Sizes:
1. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, ASTM A74, NSF Certified, CISPI Trademark.
 2. Joints: Compression gasket, ASTM C564 or lead and oakum, ASTM B29.
 3. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 3011. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
 4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

- C. Piping - 1-1/2" through 15":
1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.
 2. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
 3. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
 4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 3011. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
 5. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
- D. Piping - 1-1/4" through 4":
1. Pipe: Type M hard temper seamless copper drainage tube, ASTM B306.
 2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 3. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.
- E. Piping - 1-1/4" through 16" (Maximum Design Temperature: 140°F):
1. Pipe: Schedule 40 rigid, unplasticized PVC-DWV, or ABS-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
 2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
 3. Fittings: Unplasticized PVC-DWV, or ABS-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe.
 4. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed or in return air plenums.
 5. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.
- F. Vent Flashing: Flash vents with premolded EPDM pipe flashing cones for single-ply membrane roofs.

2.5 SANITARY DRAINAGE (BELOW GROUND - INSIDE BUILDING)
SANITARY VENT (BELOW GROUND - INSIDE BUILDING)
STORM DRAINAGE (BELOW GROUND - INSIDE BUILDING)

- A. Design Pressure: Gravity
Maximum Design Temperature: 180°F
- B. Piping - All Sizes:
1. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, ASTM A74, NSF certified, CISPI trademark.
 2. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
 3. Joints: Compression gasket, ASTM C564.

4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
- C. Piping - 1-1/2" through 15":
1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.
 2. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
 3. Joints: Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
 4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
- D. Piping - 1-1/4" through 16" (Maximum Design Temperature: 140°F):
1. Pipe: Schedule 40 rigid, unplasticized PVC-DWV, or ABS-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
 2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
 3. Fittings: Unplasticized PVC-DWV, or ABS-DWV, normal impact Type I, with solvent-weld socket ends for Schedule 40 pipe.
 4. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.

2.6 SANITARY DRAINAGE (BELOW GROUND - OUTSIDE OF BUILDING) STORM DRAINAGE (BELOW GROUND - OUTSIDE OF BUILDING)

- A. Design Pressure: Gravity
Maximum Design Temperature: 160°F
- B. Piping - All Sizes:
1. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, ASTM A74, NSF Certified, CISPI Trademark.
 2. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
 3. Joints: Compression gasket, ASTM C564.
 4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
- C. Piping - 1-1/2" through 15":
1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark
 2. Pipe and Fittings: Standard weight cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.

3. Joints: Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
 4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
- D. Piping - All Sizes (Maximum Design Temperature: 140°F):
1. Pipe and Fittings: PVC pipe, Schedule 40 and SDR 26 or less with bell and spigot ends, ASTM D1785 or ASTM D3034. Cellular core piping is not acceptable.
 2. Joints: Elastomeric gaskets, ASTM F477.
 3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
 4. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.

2.7 LOCK OUT TRIM

- A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°F, in compressed air piping, and as indicated on the drawings.

2.8 VALVE OPERATORS

- A. Provide handwheels for gate valves and gear operators for butterfly valves.

2.9 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

2.10 CONNECTIONS BETWEEN DISSIMILAR METALS

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
1. Iron and steel connected to each other.
 2. Brass, copper, and bronze connected to each other.
 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
1. Dielectric waterway rated for 300 psi CWP and 225°F.

2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 647, Grinnell Series 407, Matco-Norca.
- F. Flanged Joints (any size):
1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
 6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.

3.2 TESTING PIPING

- A. Sanitary Drainage:
Sanitary Vent:
 1. Test all piping with water to prove tight.
 2. Test piping before insulation is applied.
 3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
 4. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
 5. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.
- B. Hot Water - Potable and Non-Potable:
Cold Water - Potable and Non-Potable:
Service Water:
 1. Test pipes underground or in chases and walls before piping is concealed.
 2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.

3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
 4. Hold test pressure for at least 2 hours.
 5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
- C. Fire Service:
1. Hydrostatically test the entire system for two hours at 200 psig. Maximum leakage shall be:
 - a. Interior Piping: 0 quarts per hour.
 - b. Underground Piping: 2 quarts per 100 joints per hour.
- D. All Other Piping:
1. Test piping at 150% of normal operating pressure.
 2. Piping shall hold this pressure for one hour with no drop in pressure.
 3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
 4. Drain and clean all piping after testing is complete.

3.3 CLEANING PIPING

- A. Assembly:
1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
 3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.
- B. All Water Piping:
1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
 2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
 3. If necessary, remove valves to clean out all foreign material.
- C. Fire Service:
1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
 - a. 390 gpm for 4" pipes.
 - b. 880 gpm for 6" pipes.

3.4 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
8. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.

B. Installation Requirements In Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Provide clearance for installation of insulation and access to valves and fittings.
2. Provide access doors for concealed valves and fittings.
3. Install valve stems upright or horizontal, not inverted.
4. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.

D. Underground Piping:

1. Install buried water piping outside the building with at least 5 feet of cover. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements
2. Underground fire protection service piping shall have at least 6-1/2 feet of cover, or as recommended by NFPA 24.
3. Install thrust blocking and restraints on all underground fire protection service piping per NFPA 24 and as shown on drawings.
4. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
 - a. Acceptable Manufacturer: Republic Steel Corp. "X-Tru-Coat"
5. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
6. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
7. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any

defects in the protective coatings shall be repaired in accordance with requirements for original coatings.

8. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary Piping:

1. Install all sanitary piping inside the building with a slope of at least the following:

<u>Pipe Size</u>	<u>Minimum Slope</u>
3" and under	- 0.25" per foot
4" and over	- 0.125" per foot

2. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 3 feet per second.
3. All sanitary piping shall have at least 42" of cover when leaving the building.
4. Starter fittings with internal baffles are not permitted.

3.5 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

3.6 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water and compressed air lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

3.7 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.
- D. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- E. In no case shall the vent through the roof be less than 4" in diameter.
- F. Vent pipes through the roof shall be located a minimum of 15 feet from any air intake or exhaust opening on the roof.

3.8 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
 - 1. Domestic water piping above grade.
- E. Further limit use of mechanically formed fittings as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be type K or L copper tubing.
 - 3. Permanent marking shall indicate insertion depth and orientation.
 - 4. Branch pipe shall conform to the inner curve of the piping main.

5. Main must be 1" or larger.
6. Branch must be 3/4" or larger.

3.9 JOINING OF PIPE

A. Threaded Joints:

1. Threads shall conform to ANSI B2.1 "Pipe Threads".
2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
3. Protect plated pipe and valve bodies from wrench marks when making up joints.
4. Apply thread lubricant to male threads as follows:

Vents and Roof Conductors:	Red graphite
All Other Services:	Teflon tape

B. Flanged Joints:

1. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanged and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.
2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
3. Set flange bolts beyond finger tightness with a torque wrench for equal tension in all bolts. Tighten bolts so those 180° apart are torqued in sequence.
4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
 - a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
 - b. Maximum pressure rating of at least 250 psig.
 - c. Minimum temperature rating: -10°F.
 - d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Solder Joints:

1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
2. Flux shall be non-acid type.
3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

D. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless mandatory local codes take precedence.

2. Furnish to the Owner's Representative prior to start of work certificates qualifying each welder.
 3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
- E. Mechanically Coupled Grooved Joints:
1. Mechanical coupling connections shall mechanically engage, lock and seal the grooved pipe ends in a positive couple. Each coupling shall consist of malleable iron housing clamps, steel bolts and nuts, and sealing gasket designed so internal pressure tends to increase the tightness of the seal.
 2. Use grooved mechanical couplings and fasteners only in accessible locations.
 3. Final tightening of bolts shall be with a torque wrench for equal tension in all bolts.
- F. Mechanical Press Connection:
1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
 2. Fully insert tubing into the fitting and mark tubing.
 3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
 4. Joint shall be pressed with a tool approved by the manufacturer.
 5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.
- G. Mechanical Joints:
1. Joints shall conform to ANSI A21.11 "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings". Gasket material shall be neoprene. The standard bolts and nuts of the pipe manufacturer shall be used and shall be coated at the factory with rust preventive lubricant after threading and tapping.
 2. Final tightening of bolts shall be with a torque wrench to insure equal tension in all bolts.
- H. Push-On Joints - Pressure Pipe:
1. Joints shall be single gasket type conforming to ANSI A21.11 "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings". The bell shall have cast or machined gasket socket recesses, a tapered annular opening and flared socket design to provide deflections up to 5°. Plain spigot ends shall be suitably beveled for easy entry into bell, centering in gasket and compression of gasket.
 2. The joint shall be liquid tight under all pressures from vacuum to 350 psig.
 3. Furnish sufficient lubricant for a thin coat on each spigot end. Lubricant shall be non-toxic, impart no taste or odor to conveyed liquid, and have no deleterious effect on the rubber gasket. Lubricant shall be of such consistency that it can be easily applied to the pipe in hot and cold weather and shall adhere to either wet or dry pipe.
- I. Solvent Weld Joints (PVC):
1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.
- J. Elastomeric Gaskets (Sanitary and Storm Pipe):
1. Hub and spigot pipe joints with elastomeric gaskets shall be made in accordance with the manufacturer's installation instructions.

- K. Sleeve Gaskets (No-Hub) (Sanitary and Storm Pipe):
 - 1. Gasket shall be heavy weight class, conforming to ASTM C564.
 - 2. The gasket shall have an internal center stop.
 - 3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.
 - 4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.
- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- D. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- E. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- F. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- G. Verify initial chlorination levels by testing at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main.
- H. Maintain disinfectant in system for 24 hours, after which test at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main. If final disinfectant residual tests less than 25 mg/L at any one of the tested outlets, flush the entire system and repeat disinfection and testing procedure.
- I. After final disinfectant residuals test at or above 25 mg/L after a minimum 24-hour duration, flush disinfectant from system at a minimum velocity of 3.0 feet/second until residual is equal to that of incoming water or 1.0 mg/L.
- J. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

3.11 SERVICE CONNECTIONS

- A. Provide new sanitary and/or storm sewer services. Before commencing work check invert elevations needed for sewer connections, confirm inverts and verify these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service with water meter with bypass valves. Provide sleeve in wall for service main per Section 22 05 29.

END OF SECTION

SECTION 22 10 23
NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Natural Gas Piping System.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

1.3 REFERENCES

- A. ANSI AGA-LC1 - Standards for Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.
- B. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- C. ASME - Boiler and Pressure Vessel Code - Section 9.
- D. ASME B1.20.1 - Pipe Threads, General Purpose.
- E. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings.
- G. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- H. ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- I. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
- J. ASME B16.39 - Malleable Iron Threaded Pipe Unions.
- K. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
- L. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
- M. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- N. ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.
- O. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
- P. ASTM A197 - Standard Specification for Cupola Malleable Iron.
- Q. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- R. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- S. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- T. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
- U. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe.
- V. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

- W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- X. NFPA 54 - National Fuel Gas Code.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 NATURAL GAS (0 TO 125 PSI)

- A. Design Pressure: 125 psi.
Maximum Design Temperature: 350°F
- B. Piping - 2" and Under:
 - 1. Pipe: Standard weight steel, threaded and coupled, ASTM A53.
 - 2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
 - 3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.
 - 4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.
- C. Piping - 2" and Under:
 - 1. Pipe: Standard weight steel, plain end sanded smooth, ASTM A53.
 - 2. Joints: Mechanical press connection.
 - 3. Fittings, Valves and Unions: ASTM A106 Grade A steel with zinc-nickel coating to reduce corrosion, with embedded HNBR sealing element. ANSI LC 4 approved.
 - 4. Acceptable Manufacturers: Conbraco "Apollo" (Powerpress), Viega (Megapress).
- D. For Underground Gas Piping - Refer to paragraph "Underground Piping Protection."
- E. Shutoff Valves/Throttling Valves:
 - 1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
 - 2. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing. Apollo #80-100, Nibco #T580-70-UL or #T585-70-UL, Watts #B-6000.
 - 3. PL-1: 2" and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port. Walworth #1700, DeZurik #425, S-RS49.

2.2 DRAIN VALVES AND BLOWDOWN VALVES

- A. Drain valve and blowdown valve shall mean a shutoff valve as specified for the intended service with added 3/4" male hose thread outlet, cap, and retaining chain.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.

- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- D. Connect to all equipment with flanges or unions.

3.2 TESTING PIPING

- A. Low Pressure - Up to 1 psi:
 - 1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
- B. High Pressure - Above 1 psi:
 - 1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
- C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

3.3 CLEANING PIPING

- A. Assembly:
 - 1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
 - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
 - 3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
 - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.4 INSTALLATION

- A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
- B. Install piping to conserve building space, and not interfere with other work.
- C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Install thrust blocking and restraints on all buried piping at elbows and other changes in pipe direction.
- G. Provide clearance for access to valves and fittings.
- H. Provide access doors where valves are not exposed.
- I. Prepare pipe, fittings, supports, and accessories for finish painting.
- J. Install valves with stems upright or horizontal, not inverted.
- K. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.

- L. Provide shutoff valves to isolate part of systems and vertical risers.
- M. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
- N. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
- O. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.
- P. Seal pipes passing through exterior walls with a wall seal per Section 23 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- Q. Refer to Section 23 05 00 for Excavation, Fill, Backfill and Compaction requirements.
- R. All vertical pipe drops to equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.
- S. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

3.5 BONDING AND GROUNDING

- A. Each above ground portion of a corrugated stainless steel tubing gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream corrugated stainless steel tube fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of corrugated stainless steel tubing shall be bonded in accordance with this section.
- B. Each above ground portion of a gas piping system, other than corrugated stainless steel tubing systems, that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping, other than corrugated stainless steel tubing, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.
- C. Gas piping shall not be used as a grounding conductor or electrode.
- D. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.

3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.
- B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. **All fittings shall be long radius type**, unless otherwise shown on the drawings or specified. Construct welded

elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.

- F. Use full and double lengths of pipe wherever possible.
- G. Cut all pipe to exact measurement and install without springing or forcing.
- H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.
- I. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.

3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.
- B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.
- C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

3.8 BRANCH CONNECTIONS

- A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. All branch piping connections for natural gas shall take off on the top or on the side of the main.

3.9 JOINING OF PIPE

- A. Threaded Joints:
 - 1. Ream pipe ends and remove all burrs and chips.
 - 2. Protect plated pipe and valve bodies from wrench marks when making up joints.
 - 3. Apply Teflon tape to male threads.
- B. Flanged Joints:
 - 1. Steel flanges shall be raised face.
 - 2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
 - 3. Torque bolts in at least three passes, tightening to 1/3, 2/3, and final torque in a cross pattern with an indicating torque wrench for equal tension in all bolts.
 - 4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
 - a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
 - b. Maximum pressure rating of at least 250 psig.
 - c. Minimum temperature rating: -10°F.

- d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Fusion Weld:

1. Make all field cuts of pipe square and true using a pipe cutter designed for plastic pipe.
2. Make sure proper heating heads are used for male and female situations.
3. Bevel the leading edge of pipe section with a 45° chamfer.
4. Utilize a fusion welding tool recommended and/or provided by the pipe and fitting manufacturer.
5. Not recommended for temperatures below 40°F.
6. Follow the manufacturer's cold weather installation procedures.
7. All installers shall undergo training provided by the manufacturer or manufacturer's representative.
8. Follow all manufacturers' installation instructions.

3.10 PAINTING EXPOSED PIPE

- A. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

3.11 SERVICE CONNECTIONS

- A. Provide new gas service complete with gas meter and regulators. Verify gas service pressure with the Utility Company.

END OF SECTION

SECTION 22 10 30
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cleanouts.
- B. Traps.
- C. Trap Seals.
- D. Floor Drains and Sinks
- E. Backflow Preventers.
- F. Strainers.
- G. Unions.
- H. Balancing Valves.
- I. Water Hammer Arresters.
- J. Dielectric Fittings (Connections Between Dissimilar Metals).
- K. Air Vents.
- L. Drain Valves.

1.2 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.3 REFERENCES

- A. ANSI A112.21.1 - Floor Drains.
- B. ASSE 1010 - Water Hammer Arresters.
- C. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.
- D. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.
- E. ANSI 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering.
- F. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 1.
- G. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering.
- H. ASSE 1047 - Reduced Pressure Detector Assemblies.
- I. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- J. PDI WH-201 - Water Hammer Arresters.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Include sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer shall provide special seismic certification per OSHPD CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Provide cleanouts as shown and specified on the drawings as well as required by code.
- B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
- C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.
- D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.2 TRAPS

- A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:
 - 1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.
 - 2. Insulated at accessible lavatories.
 - 3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.
 - 4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.
- B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.
- C. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water and a 1/2" minimum layer of mineral oil.

2.3 TRAP SEALS AND PRIMERS

- A. Provide trap seals as specified on the drawings.
- B. Provide trap primers as shown and specified on the drawings.

2.4 FLOOR DRAINS AND SINKS

- A. Floor drains and sinks shall be in the form of a receptor with grate/strainer set flush with the surrounding floor.
- B. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

2.5 BACKFLOW PREVENTERS

- A. Provide backflow preventers as shown and specified on the drawings as well as required by code.

2.6 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

Pipe Size	1/4" - 2"	2-1/2" - 10"
air	1/32"	3/64"
water	3/64"	1/16"

- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
- C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.7 UNIONS

- A. Copper pipe - wrought copper fitting - ground joint.
- B. Black Steel (Schedule 40) Pipe - malleable iron, ground joint, 150 psi, bronze to bronze seat.
- C. Galvanized Steel Pipe - galvanized malleable iron, ground joint, 150 psi, bronze to bronze seat.

2.8 BALANCING VALVE

- A. Rated for 125 psi working pressure and 250°F operating temperature, taps for determining flow with a portable meter, positive shutoff valves for each meter connection, memory feature, tight shutoff, and a permanent pressure drop between 1' and 2' water column at full flow with valve 100% open. Furnish with molded, removable insulation covers.
- B. Provide a nomograph to determine flow from meter reading (and valve position on units which sense pressure across a valve). Graph shall extend below the specified minimum flow.
- C. Flow rate of 0.5 GPM or larger: Valves in copper piping shall be brass or bronze. Acceptable Manufacturers: Flow Design "Accusetter", Preso "B+", Armstrong "CVB", Bell & Gossett "Circuit Setter Plus", Griswold "Quickset", Gerand "Balvalve Venturi" or Nibco Globe Style balancing valve.
- D. Flow rate less than 0.5 GPM: Valves in copper piping shall be brass or bronze. Cv value shall be less than 1.0 when valve is completely open, and minimum balanceable flow rate shall not exceed 0.1 GPM with a meter reading of at least 2.5 feet. Acceptable manufacturers: Bell & Gossett "Circuit Setter RF", Flow Design, Preso, Armstrong, Griswold, Gerand, or Nibco balancing valve.
- E. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on manufacturer's standard meters.

2.9 WATER HAMMER ARRESTERS

- A. Provide water hammer arresters as shown and specified on the drawings as well as required by code.
- B. ANSI A112.26.1; sized and located in accordance with PDI WH-201, precharged for operation between -100°F and 300°F and maximum 250 psig working pressure.

2.10 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron, steel, and stainless steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.

- E. Screwed Joints (acceptable up to 2" size):
 - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
 - 2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.
- F. Flanged Joints (any size):
 - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
 - 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
 - 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
 - 6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

2.11 AIR VENTS

- A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
- B. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

2.12 DRAIN VALVES

- A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.
- C. Water Hammer Arresters and Air Chambers:
 - 1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Engineer/Owner.
 - 2. Water hammer arrestors shall be installed in cold and hot water lines upstream of all plumbing fixtures or equipment, with a quick acting valve or multiple quick acting valves. Quick acting valves shall be defined as solenoid actuated valves, manual flush valves, sensor activated faucets and flush valves, squeeze handle spray faucets, and other similar type valves.
 - 3. Install multiple water hammer arrestors in toilet group branch piping greater than 20 feet in developed length from the cold and hot water mains.
 - 4. Install air chambers at each fixture not protected by a water hammer arrester.
- D. Cleanouts:
 - 1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet.
 - 2. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.

3. Extend cleanouts to the floor with long sweep elbows.
 4. Install a full size, two-way cleanout within 5 feet of the foundation inside or outside of building.
 5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
 6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.
- E. Trap Seals:
1. Install trap guard on drains not receiving continuous discharge and subject to drying out.
- F. Floor Drains and Floor Sinks:
1. Use alternate sealing method when installing drains in existing floor slabs.
 2. Coordinate sloping requirements with the architectural plans and specifications.
 3. Top of floor drain and sinks grate/strainer shall not extend above the finished floor elevation.
 4. Top of floor drain and sink grate/strainer shall not extend above the finished floor elevation. Grate/strainer shall be installed flush with surrounding finished floor. Should the Plumbing Contractor believe this presents a conflict with code, the issue should be evaluated before installation of the floor drain or sink begins. Proceeding with installing a floor drain or sink raised above the finished floor without prior approval will result in the Contractor being required to remove the drain or sink in question and reinstall it at the approved elevation.
- G. Backflow Preventer:
1. Provide an air gap fitting and piping to drain. On 2-1/2" and larger units, install a tail piece from air gap fitting to drain to prevent water from spraying out of drain air gap receptor. Maintain air gap distance required by Code.
 2. Units shall be field tested and tagged in accordance with manufacturer's instructions and applicable codes by a certified tester before initial operation.
 3. Install unit between 12" and 60" above finish floor.
- H. Balancing Valves:
1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer's installation instructions.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters.

1.2 QUALITY ASSURANCE

- A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:
 - 1. American Gas Association (AGA).
 - 2. National Sanitation Foundation (NSF).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - 5. National Electrical Manufacturers' Association (NEMA).
 - 6. Underwriters' Laboratories (UL).
- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.
- C. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASME Section 8D - Pressure Vessels.
- C. ANSI Section 21.10.1 or Section ANSI 21.10.3 - Gas Water Heaters Ratings 75,000 BTU per Hour and Less.
- D. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
- E. ANSI/NFPA 54 - National Fuel Gas Code.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include heat exchanger dimensions, size of tappings, and performance data.
- D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.
- F. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.
- G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.
- H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.6 REGULATORY REQUIREMENTS

- A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.
- B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.

PART 2 - PRODUCTS

2.1 WATER HEATERS

- A. All water heaters shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all items in accordance with manufacturer's instructions.

3.2 WATER HEATER INSTALLATION

- A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 22 05 29.
- B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install gas water heaters according to NFPA 54.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All plumbing fixtures.

1.2 REFERENCES

- A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
- D. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- E. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- F. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- G. Americans with Disabilities Act (ADA), Title III.
- H. The Energy Policy Act (EPA) of 2005.

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 22 05 00. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All fixtures shall be as scheduled on the drawings.
- B. All china shall be from the same manufacturer where possible.
- C. All lavatory and sink trim shall be from the same manufacturer where possible.
- D. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
 - 2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
 - 3. Provide fixtures with chrome plated rigid or flexible supplies, loose key stops, reducers, and escutcheons.
 - 4. Install components level and plumb.
 - 5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.

6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
 7. Refer to Plumbing Material List for fixture mounting heights.
 8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
- B. Wall-Mounted Fixture Requirements:
1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab.
- C. Floor-Mounted Fixture Requirements:
1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.
- D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:
1. All traps exposed under fixtures or inside accessible cabinets shall be chrome plated brass.
 2. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
 3. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
 4. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.
- E. ADA Accessible Exposed Sink and Lavatory Trim:
1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.
- F. ADA Accessible Water Closet Requirements:
1. Handicapped accessible water closet flush valve handles shall face the center of the stall.
 2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.
- G. Shower Requirements:
1. All acrylic and fiberglass showers shall have a non-shrink grout or manufacturer-approved material installed between the finished floor and floor of the fixture to prevent damage caused by deflection.
 2. All rough-in pockets for showers located in basement floor installations shall be filled in with concrete and sealed tight.

3.2 ADJUSTING AND CLEANING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.3 FIXTURE ROUGH-IN SCHEDULE

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION

SECTION 23 05 00
BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Furnish and install a new domestic water service to the building.
 - c. Furnish and install water meter and domestic water backflow preventer as required by Code.
 - d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
 - e. Furnish and install gas piping system including all meter requirements.
 - f. Furnish and install water heater.
 - g. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
 - h. Furnish and install a complete sanitary sewer and vent system.
 - i. Furnish and install site sanitary sewer piping, cleanouts, and manholes.
 - 2. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install air-cooled condensing units.
 - c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - e. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - f. Furnish and install gas flues, stacks, and breechings.

- g. Furnish and install all temperature control systems.
- h. Furnish and install all fire dampers.
- 3. Fire Protection Work shall include, but is not necessarily limited to:
 - a. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
 - b. Furnish and install a complete wet pipe sprinkler system for areas noted on the drawings.
 - c. Furnish and install all items listed on the Fire Protection Material List.
 - d. Furnish all hydraulic calculations and working sprinkler drawings.
- 4. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
 - a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

- 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Air Conditioning and Ventilating Contractor.
 - c. Fire Protection Contractor.
 - d. Testing, Adjusting, and Balancing Contractor.
- 2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
- 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
- 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
- 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
- 6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

- C. Mechanical Contractor's Responsibility:
 - 1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
 - a. Condensing Units.
 - b. Gas Trains.
 - c. Package Air Handling Units.
 - 2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
 - 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
 - 1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
 - 2. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
 - 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 QUALITY ASSURANCE

- A. Contractor's Responsibility Prior to Submitting Pricing Data:
 - 1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
 - 2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.
- B. Qualifications:
 - 1. Only products of reputable manufacturers are acceptable.
 - 2. All Contractors and subcontractors shall employ only workers skilled in their trades.
- C. Compliance with Codes, Laws, Ordinances:
 - 1. Conform to all requirements of the City of Colfax, Iowa's Codes, Laws, Ordinances and other regulations having jurisdiction.
 - 2. Conform to all State Codes.

3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 4. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
 5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
 6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.
- E. Utility Company Requirements:
1. Secure from the appropriate private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. Make application for and pay for service connections, such as gas.
 4. Make application for and pay for all meters and metering systems required by the utility company.
- F. Examination of Drawings:
1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
 3. Scaling of the drawings is not sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
 6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
 7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
 8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.
- G. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.
- H. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
 5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
 6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
 7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
 8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.5 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification	Submittal Item
<u>Section</u>	
23 05 00	Owner Training Agenda
23 05 03	Fire Seal Systems
23 05 93	Testing, Adjusting, and Balancing
23 31 00	Ductwork
23 31 00	Ductwork Layout Drawings
23 33 00	Fire Dampers
23 34 23	Power Ventilators
23 37 00	Grilles, Registers, and Diffusers
23 37 00	Louvers
23 54 00	Furnaces
23 81 26	Split System Air Conditioning Units
23 82 00	Terminal Heat Transfer Equipment

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps

3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the**

Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 23 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 23 XX XX.description.YYYYMMDD
 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.6 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 - 2. Submit in Excel format.
 - 3. Support values given with substantiating data.
- C. Preparation:
 - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 - 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
 - 3. Indicated by Architect/Engineer.
 - 4. Change of subcontractor or supplier occurs.
 - 5. Change of product or equipment occurs.

1.7 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 - 1. Furnaces
 - 2. Split System Air Conditioning Units
 - 3. Condensing Units
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging

service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.11 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
 - 4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.3 OPERATION AND MAINTENANCE MANUALS

- A. General:
 - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected,

electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div23.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.4 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
 1. Explanation of all air handling systems.
 2. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
 3. Maintenance of equipment.
 4. Start-up procedures for all major equipment.
 5. Explanation of seasonal system changes.
- E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.
- F. Minimum hours of instruction for each item shall be:
 1. Air Handling System(s) - 4 hours.
- G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- H. Operating Instructions:
 1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
 2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.5 SYSTEM STARTING AND ADJUSTING

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.

- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.6 RECORD DOCUMENTS

- A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of mechanical drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the mechanical systems.
- B. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- C. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.7 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.

- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
5. All temperature control systems operating, programmed and calibrated.
6. Pipe insulation complete, pipes labeled and valves tagged.
7. Fire damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

SECTION 23 05 03
THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials.
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2015 International Building Code

1.4 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - 4. F and T ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:
 - a. Floor penetrations located outside wall cavities.
 - b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following

manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated
 F Rating = Floor/Wall Rating
 T Rating = Floor/Wall Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated

F Rating = Wall Rating

T Rating = 0

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated

F Rating = Wall/Floor Rating

T Rating (Floors) = Floor Rating

<u>Penetrating Item</u>	<u>UL System No.</u>
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

- H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 23 05 13
MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single Phase and Three Phase Electric Motors.

1.2 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
E. ANSI/NEMA MG 1 - Motors and Generators.
F. ANSI/NFPA 70 - National Electrical Code.
G. Energy Independence and Security Act of 2007.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

PART 2 - PRODUCTS

2.1 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

- E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- G. Each contractor shall set all motors furnished by him.
- H. All motors shall have a minimum service factor of 1.15.
- I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- K. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.
- L. Motors for fans and pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of varying motor speed.

2.2 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

- A. All motors, unless exempted by EPCAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

HP	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5

- B. Motor nameplate shall be noted with the above ratings.

2.3 MOTOR DRIVEN EQUIPMENT

- A. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
- B. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

2.4 SHEAVES

- A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.
- B. When replacing sheaves, use sheaves of at least the originally supplied sizes.

- C. Contractor responsible for motor shall also be responsible for replacement sheaves. Coordinate with testing and balancing of the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjusting, and balancing of air systems.
- B. Testing, adjusting, and balancing of plumbing systems.
- C. Measurement of final operating condition of HVAC systems.

1.2 QUALITY ASSURANCE

- A. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

- A. AABC - National Standards for Total System Balance, 2002.
- B. ADC – Test Code for Grilles, Registers, and Diffusers.
- C. AMCA – Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-1988; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Sixth Edition, 1998.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing, Third Edition, 2002.
- H. TABB – International Standards for Environmental Systems Balance.

1.4 SUBMITTALS

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:
 - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.
 - 3. All text shall be searchable.
 - 4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.5 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports

required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

- C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of eight (8) manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.7 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
 - 1. General Equipment Requirements:
 - a. Equipment is safe to operate and in normal condition.
 - b. Equipment with moving parts is properly lubricated.
 - c. Temperature control systems are complete and operable.

- d. Proper thermal overload protection is in place for electrical equipment.
- e. Direction of rotation of all fans and pumps is correct.
- f. Access doors are closed and end caps are in place.
- 2. Duct System Requirements:
 - a. All filters are clean and in place. If required, install temporary media.
 - b. Duct systems are clean and free of debris.
 - c. Fire and manual volume dampers are in place, functional and open.
 - d. Air outlets are installed and connected.
 - e. Duct system leakage has been minimized.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

- A. $\pm 10\%$ of scheduled values:
 - 1. Adjust air inlets and outlets to $\pm 10\%$ of scheduled values.
- B. $+ 5\%$ of scheduled values
 - 1. Adjust outdoor air intakes to within $+ 5\%$ of scheduled values.
- C. Adjust supply, return, and exhaust air-handling systems to $+10\%$ / -5% of scheduled values.

3.5 ADJUSTING

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 GENERAL REQUIREMENTS

- A. Title Page:
 - 1. Project name.
 - 2. Project location.
 - 3. Project Architect.

4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.
- B. Report Index
- C. General Information:
 1. Test conditions.
 2. Nomenclature used throughout report.
 3. Notable system characteristics/discrepancies from design.
 4. Test standards followed.
 5. Any deficiencies noted.
 6. Quality assurance statement.
- D. Instrument List:
 1. Instrument.
 2. Manufacturer, model, and serial number.
 3. Range.
 4. Calibration date.

4.2 AIR SYSTEMS

- A. Air Moving Equipment:
 1. General Requirements:
 - a. Drawing symbol.
 - b. Location.
 - c. Manufacturer, model, arrangement, class, discharge.
 - d. Fan RPM.
 - e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
 2. Flow Rate:
 - a. Supply flow rate (cfm): specified and actual.
 - b. Return flow rate (cfm): specified and actual.
 - c. Outside flow rate (cfm): specified and actual.
 - d. Exhaust flow rate (cfm): specified and actual.
 3. Pressure Drop and Pressure:
 - a. Filter pressure drop: specified and actual.
 - b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
 - c. Inlet pressure.
 - d. Discharge pressure.

- B. Fan Data:
 - 1. Drawing symbol.
 - 2. Location.
 - 3. Manufacturer and model.
 - 4. Flow rate (cfm): specified and actual.
 - 5. Total static pressure: specified and actual. (Indicate measurement locations).
 - 6. Inlet pressure.
 - 7. Discharge pressure.
 - 8. Fan RPM.
- C. Electric Motors:
 - 1. Drawing symbol of equipment served.
 - 2. Manufacturer, Model, Frame.
 - 3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
 - 4. Measured: Amps in each phase.
- D. Fire Dampers:
 - 1. Damper ID #.
 - 2. System identification.
 - 3. Type.
 - 4. Size.
 - 5. UL assembly number.
 - 6. Location of damper and access door.
 - 7. Fusible link temperature rating.
 - 8. Manufacturer and model.
 - 9. Operation pass/fail/reset.

4.3 PLUMBING SYSTEMS

- A. Balancing Valve:
 - 1. Drawing symbol.
 - 2. Service.
 - 3. Location.
 - 4. Size.
 - 5. Manufacturer and model.
 - 6. Flow rate (gpm): specified and actual.
 - 7. Pressure drop: specified and actual.
- B. Gas Fired Water Heater:
 - 1. Drawing symbol.
 - 2. Service.
 - 3. Location.
 - 4. Manufacturer and model.
 - 5. Capacity (Btuh): specified, nameplate, and actual.
 - 6. Entering water temperature: specified and actual.
 - 7. Leaving water temperature: specified and actual.

8. Pressure Drop: specified and actual.
9. Control Setting: specified and actual.

END OF SECTION

SECTION 23 07 13
DUCTWORK INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ductwork Insulation.
- B. Insulation Jackets.

1.2 QUALITY ASSURANCE

- A. Materials: UL listed in Category HNKT; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723.
- B. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ASTM E84 - Surface Burning Characteristics of Building Materials.
- C. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.
- D. ASTM E814 - Fire Tests of Through Penetrations Firestops.
- E. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
- F. NFPA 255 - Surface Burning Characteristics of Building Materials.
- G. UL - XHEZ - Through Penetration Firestop Systems.
- H. UL 263 - Full Scale External Fire Tests with Hose Stream.
- I. UL 723 - Surface Burning Characteristics of Building Materials.
- J. UL 1479 - Fire Tests of Through Penetrations Firestops.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.
- B. Type B: Semi-rigid Fiberglass Board Wrap - Outside Application; ANSI/ASTM C612, Class 1; 0.25 maximum 'K' value at 75°F; foil scrim Kraft facing, 3 lb./cu. ft. density.
- C. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 4000 fpm air velocity.
- D. Type E: Double wall ductwork insulation; fiberglass; 0.27 maximum 'K' value at 75°F mean temperature; 1.5 lb/cu ft density.

2.2 JACKETS

- A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.
- B. Install materials after ductwork has been tested.
- C. Clean surfaces for adhesives.
- D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
- E. Exterior Duct Wrap - Flexible, Type A:
 - 1. Apply with edges tightly butted.
 - 2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.
 - 3. Seal joints with adhesive backed tape.
 - 4. Apply so insulation conforms uniformly and firmly to duct.
 - 5. Provide high-density insulation inserts at trapeze duct hangers and straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.
 - 6. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.
 - 7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.
 - 8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
 - 9. Staples may be used, but must be covered with tape.
 - 10. Vapor barrier must be continuous.
 - 11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.
- F. Semi Rigid Fiberglass Board Wrap - Type B (Indoor Use):
 - 1. Impale on pins welded to the duct and secured with speed clips. Clip pins off close to speed clips.
 - 2. Space pins as needed to hold insulation firmly against duct, but not less than one pin per square foot. Pins must be long enough to avoid compressing the insulation.
 - 3. Seal all joints and speed clips with glass fabric set in adhesive or a 3" wide strip of Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK facing tape.
 - 4. For small areas, secure insulation with adhesive over the entire surface of the duct. Use adhesive in addition to pins as needed to prevent sagging on horizontal surfaces.
- G. Interior Insulation - Flexible Duct Liner, Type C:
 - 1. Observation of Duct Lining:
 - a. After installation of ductwork, Architect/Engineer may select random observation points in each system.
 - 1) At each observation point, cut and remove an 18" x 18" section of ductwork and liner for verification of installation.

- 2) Random observation points based on one opening per 75 lineal ft. of total duct run.
 - b. When any of the observation points shows non-compliance, additional points will be designated by the Architect/Engineer, and observation repeated.
 - c. If 20% of points observed do not comply, remove and replace all lined ducts and repeat tests. Where replacement is not required, correct all non-compliances.
 - d. At end of observation, repair all duct lining and observation holes by installing standard, insulated, hinged access doors per Section 23 33 00.
 - e. Paint or finish to match adjacent duct surfaces.
2. Impale on spindle anchors welded or mechanically fastened to the duct. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins less than 3" from corners and at intervals not over 6" around the perimeter at leading and trailing edges. Locate pins within 3" of transverse joints and at intervals not over 16" long the length of the duct. Pins must be long enough to prevent compressing the insulation.
 3. In addition to anchors, secure liner with UL listed adhesive covering over 90% of the duct surface.
 4. Install per the latest edition of the SMACNA Manual.
 5. Leading edges shall be covered as follows:
 - a. For duct velocities below 3000 fpm, coat leading edges with adhesive. Neatly butt liner without gaps at transverse joints. Cut liner flush with end of the duct section for tight joints with no exposed duct. If adhesive is shop installed, field apply additional adhesive to the end of each duct section for complete adhesion of the liner. Protect edges from dirt and debris.
 - b. For duct velocities above 3000 fpm, cover leading edges with metal nosing. Use nosing on upstream edges of each section of duct. If the duct can be installed in either direction, provide nosing on each end or clearly mark the duct to allow visual verification after installation. Verify duct velocities based on the scheduled air flow rates and determine where metal nosing is required.
 - c. Install metal nosing in the following locations (regardless of velocity):
 - 1) The first three fittings downstream of all fans.
 - 2) At all duct liner interruptions. This includes fire dampers, access doors, branch connections, and all other locations where the edge of the liner is exposed.
 - 3) Trailing edges of transverse joints do not require metal nosings.
 6. Overlap liner at longitudinal joints. Make longitudinal joints at corners of the duct unless the duct size does not allow this. Coat longitudinal joints with adhesive at velocities over 2500 fpm.
 7. Seal all damaged duct liner with adhesive and glass cloth. Do not damage duct liner surface coatings.
 8. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.

- H. Double-Wall Ductwork Insulation - Type E:
 - 1. Install insulation per manufacturer's recommendations.
 - 2. Duct dimensions given are net inside dimensions of inner wall.
- I. Continue insulation with vapor barrier through penetrations unless code prohibits.
- J. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.2 SCHEDULE

- A. Refer to Section 23 31 00 for scheduling of insulation.

END OF SECTION

SECTION 23 31 00
DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Aluminum Ductwork
- C. Ductwork Sealants
- D. Rectangular Ductwork
- E. Round and Flat Oval Ductwork
- F. Exposed Ductwork (Rectangular, Round, or Oval)
- G. Flexible Duct

1.2 REFERENCES: Conform to all applicable requirements of the following publications:

- A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASHRAE - Handbook 2012 Systems and Equipment; Chapter 19 - Duct Construction.
- D. ASHRAE - Handbook 2013 Fundamentals; Chapter 21 - Duct Design.
- E. ASTM A90 - Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- F. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.
- G. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- H. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- I. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- J. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- K. ASTM E413-87 - Classification for Rating Sound Insulation.
- L. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
- M. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- N. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
- O. SMACNA – Air Duct Leakage Test Manual – 1985 Edition.
- P. SMACNA - HVAC Duct Construction Standards - 2005 Edition.
- Q. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.
- R. UL 181 - Factory-Made Air Ducts and Air Connectors.
- S. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
- T. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00.
- B. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the

contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.

- C. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:
1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
 2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
 3. Room names and numbers, ceiling types, and ceiling heights.
 4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
 5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor's use if the contractor signs and returns the "Electronic File Transfer" waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 23 05 00.

1.4 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.
- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.

PART 2 - PRODUCTS

2.1 GALVANIZED DUCTWORK

- A. General Requirements:
1. Duct and reinforcement materials shall conform to ASTM A653 and A924.
 2. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
 3. Ductwork reinforcement shall be of galvanized steel.
 4. Ductwork supports shall be of galvanized or painted steel.
 5. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel attached to the bottom of ducts
 6. Aircraft cable and slip cable hangers are acceptable for ducts up to 18"ø. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved. All fasteners shall be galvanized or cadmium plated.

2.2 ALUMINUM DUCTWORK

- A. General Requirements:
1. Material: ASTM B209; aluminum sheet, Alloy 3003-H14. Aluminum connectors and bar stock: Alloy 6061-T6. Aluminum or stainless steel fasteners are acceptable.
 2. All duct gauges and reinforcement shall be as called for in Tables 2-50, 2-51, 2-52, and 3-14 of the SMACNA HVAC Duct Construction Standards.
 3. Ductwork reinforcement shall be of aluminum.

4. Ductwork supports shall be of aluminum, galvanized steel or painted steel. Slip cable hangers are acceptable. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.
5. All other requirements are as noted for galvanized rectangular sheet metal duct.

2.3 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M.
- B. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.
- C. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F. Acceptable manufacturers include: Venture Tape 1581A, Compac #340, Scotch Foil Tape 3326, Polyken 339.

2.4 RECTANGULAR DUCT - SINGLE WALL

- A. General Requirements:
 1. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
 2. Transitions shall not exceed the angles in Figure 4-7.
- B. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:
 1. All ducts shall be cross-broken or beaded.
 2. Snap lock seams are not permitted.
 3. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
 - a. Type 1:
 - 1) **Description:** Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
 - 2) **Usage:** Limited to 3,000 fpm and vane lengths 36" and under.
 - b. Type 2:
 - 1) **Description:** Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
 - 2) **Usage:** No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.

- c. Type 3 (acoustical - where acoustical lagging is located or as noted on drawings):
 - 1) **Description:** Same as Type 2, except filled with fiberglass and with slotted or perforated inner curve. Minimum insertion loss of 9 dB at 250 Hz and 6 dB at 1 KHz.
 - 2) **Usage:** No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
- d. Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
- e. Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
- f. Omitting every other vane is prohibited.
- 4. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. **Mitered elbows (with or without turning vanes) may not be substituted for radius elbows.** Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.
- 5. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
- 6. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
- 7. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
- 8. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
- 9. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
- 10. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - a. Apply sealant to all inside corners. Holes at corners are not acceptable.
 - b. Acceptable Manufacturers: Ductmate Industries - 25/35/45, Nexus, Mez, or WDCI. Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

11. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - a. Apply sealant to all inside corners. Holes at corners are not acceptable.
 - b. Flanges shall be 24-gauge minimum (not 26 gauge).
 - c. Acceptable Manufacturers: Lockformer TDC, TDF, United McGill, or Sheet Metal Connectors. Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

2.5 ROUND AND FLAT OVAL SPIRAL SEAM DUCTWORK - SINGLE WALL

- A. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
- B. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.
- C. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
- D. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
- E. Ductwork shall be suitable for velocities up to 5,000 fpm.
- F. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
- G. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
- H. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
- I. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
- J. Transverse Joint Connections:
 1. Crimped joints are not permitted.
 2. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
 3. Ducts and fittings larger than 36" shall have flanged connections.
 4. Secure all joints with at least 3 sheet metal screws before sealing.
 5. Slide-on flanges as manufactured by Ductmate Industries - SpiralMate, Accuflange, or Sheet Metal Connectors are acceptable. Self-sealing duct systems are also acceptable (Lindab, Ward "Keating Coupling").

2.6 ROUND AND FLAT OVAL SPIRAL SEAM DUCTWORK - DOUBLE WALL

- A. Conform to applicable portions of Rectangular Duct Section. Spiral seam round or flat oval double wall ductwork may be substituted for double wall rectangular ductwork where approved by the Architect/Engineer. Double wall spiral seam ductwork shall meet the standards set forth in this specification. Ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation. Interior wall shall be perforated if substituting for lined or double wall rectangular ductwork.
- B. Interior ducts shall have an airtight outer pressure shell, a 1" insulation layer, and a solid inner wall that completely covers the insulation.
- C. Exterior ducts shall have an airtight outer pressure shell, a 2" insulation layer, and a solid inner wall that completely covers the insulation.
- D. Insulation shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- E. 90° elbows shall be smooth radius or have a minimum of 5 mitered joints, and R/D of at least 1.5.
- F. Duct and Fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA standards for the specified pressure class. Ribbed and lightweight duct are not permitted.
- G. Ductwork shall be suitable for up to 5,000 fpm velocity.
- H. Divided flow fittings may be separate fittings or factory installed taps with the following construction requirements:
 - 1. Sound airtight, continuous welds at intersection of fitting body and tap.
 - 2. Tap liner welded to inner liner with weld spacing not over 3".
 - 3. Insulation packed around the tap area for complete cavity filling.
 - 4. Carefully fit branch connections to cut-out openings in inner liner without spaces for air erosion of insulation or sharp projections for noise and airflow disturbance.
- I. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
- J. Support inner liner of ducts and fittings with metal spacers welded to maintain spacing and concentricity.
- K. Ducts with minor axis under 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
- L. Transverse Joint Connections:
 - 1. Crimped joints are not permitted.
 - 2. Provide couplings to align the inner liners. Butt joints are not permitted for inner liners. Make alignment by extending the liner of the fitting into the duct or by using a double concentric coupling with the two couplings held by spacers for rigidity and wall spacing.
 - 3. Above 34" ID provide a separate coupling for inner alignment with the pressure shells joined by angle ring flanged connections.
 - 4. Use outside slip couplings for fitting-to-fitting joints.
 - 5. Secure all joints with at least 3 sheet metal screws before sealing.
 - 6. Slide-on flanges as manufactured by Ductmate Industries - SpiralMate, Accuflange or Sheet Metal Connectors are acceptable. Self-sealing duct system is also acceptable (Lindab, Ward "Keating Coupling").

2.7 EXPOSED DUCTWORK (RECTANGULAR, ROUND, AND FLAT OVAL)

- A. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:
 - 1. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
 - 2. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
 - 3. Remove all identification stickers and thoroughly clean exterior of all ducts.
 - 4. Locate fitting seams on least visible side of duct.
 - 5. Provide exterior finish suitable for field painting without further oil removal.
 - 6. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct. Slide-on flanges as manufactured by Ductmate Industries, Accuflange or Sheet Metal Connectors are acceptable. Self-sealing duct system is also acceptable (Lindab, Ward "Keating Koupling").
 - 7. The system shall be free of visible dents and scratches when viewed from normal occupancy.
- B. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:
 - 1. Metal gauge of duct and fittings.
 - 2. Fitting type and construction.
 - 3. Type and size of reinforcement.
- C. Hangers for Exposed Ductwork:
 - 1. Round Ducts:
 - a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18"Ø. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Spacing and cable size as required by SMACNA guidelines. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.
 - 2. Rectangular Ducts
 - a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18" in maximum dimension. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required by SMACNA guidelines. Acceptable manufacturers are Gripple, Ductmate, Duro Dyne, or Architect/Engineer approved.
 - 3. Strut-channel and all-thread rod is not acceptable for exposed ductwork.
 - 4. All fasteners shall be galvanized or cadmium plated.

2.8 FLEXIBLE DUCT

- A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.
- B. Flame Spread/Smoke Developed: Not over 25/50.
- C. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.

- D. Inner liner shall be airtight and suitable for 6" WC static pressure through 10" diameter and shall be airtight and suitable for 4" WC static pressure 12" through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft²*°F*hr/Btuh. Temperature range of at least 0-180°F. Maximum velocity of 4,000 fpm.
- E. Usage:
 - 1. Connections to air inlets and outlets. Do not exceed 6'-0" in length.
- F. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.
- G. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Repair all duct insulation and liner tears.
- F. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.
- G. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- H. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.
- I. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible.
- J. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- K. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

3.2 DUCTWORK APPLICATION SCHEDULE

USAGE	MATERIAL	PRESSURE CLASS	SEAL CLASS †	INSULATION (Refer to Section 23 07 13 for insulation types) [±]
Supply Duct from Fan to Outlets – Single Wall	Galvanized Sheet Metal - Rectangular	+2"	A	1" thick Type C (R=3.6)

USAGE	MATERIAL	PRESSURE CLASS	SEAL CLASS †	INSULATION (Refer to Section 23 07 13 for insulation types)±
Supply Duct from Fan to Outlets – Single Wall	Galvanized Sheet Metal - Spiral Seam Round	+2"	A	1-1/2" thick Type A (R=4.5)
Supply Duct from Fan to Outlets	Galvanized Sheet Metal w/Slide-On Flange System or Formed-on Flanges	+2"	A	or 1" thick Type C (R=3.6)
Exterior Supply Duct from Fan to Outlets – Double Wall	Galvanized Sheet Metal (spiral seam round or flat oval)	+2"	A	2" thick Type E (R=7.4)
Return Duct	Galvanized Sheet Metal	-2"	A	None
General Exhaust Duct	Galvanized Sheet Metal	-2"	A	None
Exhaust Duct from Grille to Exhaust Duct Main	Aluminum	-2"	A	None
Outside Air Intake from Louver to Furnace	Galvanized Sheet Metal	-2"	A	1 1/2" thick Type B (R=6.0)
† Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual				
± Type A insulation (Flexible Fiberglass Wrap) R-values noted are based on installed values (25% compression).				

3.3 DUCTWORK SEALING

A. General Requirements:

1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.

B. For Seal Class A ducts, all transverse joints, longitudinal seams, and duct wall penetrations shall be sealed. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal

connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.

- C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

3.4 TESTING

- A. Duct - 2" WG or Less (positive or negative):
 - 1. Systems shall not leak more than shown in Table 4-1 of SMACNA HVAC Air Duct Leakage Test Manual for Seal Class A.
 - 2. Leak testing of these systems is not normally required for interior ductwork. However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
 - 3. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
 - 4. Seal ducts to bring the air leakage into compliance.
 - 5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- B. Test procedure shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
 - 1. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
 - 2. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
 - 3. All joints shall be felt by hand, and all discernible leaks shall be sealed.
 - 4. Totalling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
 - 5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
 - 6. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
 - 7. The required leakage class for Seal Class A, both round and rectangular ducts, shall be 4.
 - 8. Positive pressure leakage testing is acceptable for negative pressure ductwork.

3.5 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

3.6 PAINTING

- A. Paint interior of ducts black within twice the largest duct dimension of inlets and outlets where interior of duct is visible.
- B. Paint bottom of ducts black within twice the largest duct dimension where a duct is routed above an unducted perforated grill and the duct is visible.

END OF SECTION

SECTION 23 33 00
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manual Volume Dampers.
- B. Fabric Connectors.
- C. Ceiling Fire Dampers

1.2 REFERENCES

- A. ASTM E477-06a - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- B. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- C. SMACNA - HVAC Duct Construction Standards – Third Edition - 2005.
- D. UL 33 - Heat Responsive Links for Fire-Protection Service.
- E. UL 555 - Fire Dampers and Ceiling Dampers.
- F. UL 555C - Ceiling Dampers.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.
- E. Provide locking quadrant regulators on single and multi-blade dampers.
- F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

2.2 FABRIC CONNECTORS

- A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.
- B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.
- C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.
- D. Fabric connections shall not exceed 6" in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" in length.
- E. All corners shall be folded, sealed with mastic and stapled on 1" centers.
- F. Fabric connectors shall not be painted.
- G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.

- H. Acceptable Materials: Durodyne MFN-4-100, Vent Fabrics, Inc. "Ventglas", or Proflex PFC3NGA.

2.3 CEILING FIRE DAMPERS

- A. Furnish and install ceiling fire dampers where shown on the drawings, at the point where they pass through a rated ceiling, and in all other locations required by the local fire department, the NFPA Standard 90A, and all other applicable codes.
- B. Ceiling fire dampers shall be UL 555C listed for the applicable ceiling and fire resistance rating, and shall be held open by a fusible link rated at 165°F unless otherwise called for on the drawings or by local code.
- C. A means for balancing airflow shall be incorporated in the damper.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install accessories in accordance with manufacturer's instructions.
 - 2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
 - 3. Coordinate and install access doors provided by others.
 - 4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
 - 5. Provide duct test holes where indicated and as required for testing and balancing purposes.
- B. Manual Volume Damper:
 - 1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing.

END OF SECTION

SECTION 23 34 23
POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. In-Line Cabinet Fan.

1.2 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. Fabrication: Conform to AMCA 99.
- D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.0

1.3 REFERENCES

- A. AMCA 99 - Standards Handbook.
- B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
- C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- H. SMACNA - HVAC Duct Construction Standards, 1995 Edition.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).
- B. Submit manufacturer's installation instructions.
- C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

PART 2 - PRODUCTS

2.1 IN-LINE CABINET FAN

- A. Fiberglass lined, sheet metal housing, arranged for in-line installation.
- B. Rubber torsion motor mounts.
- C. Plug type disconnect.
- D. Built-in backdraft damper.
- E. Centrifugal fan.
- F. Provide variable speed controller if shown on the drawings.
- G. Acceptable Manufacturers: ACME, Broan, Carnes, Cook, Jenco, PennBarry, Greenheck, Soler-Palau.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

END OF SECTION

SECTION 23 37 00
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grilles and Registers.
- B. Architectural Square Panel Diffusers.
- C. Louvers.

1.2 QUALITY ASSURANCE

- A. Test and rate performance of air inlets and outlets per ASHRAE 70.
- B. Test and rate performance of louvers per AMCA 500L-99.
- C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

- A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.
- B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. SMACNA - Duct Construction Standards.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 23 05 00.
- B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.
- C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.
- D. Submit manufacturer's installation instructions.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.
- B. Conform to ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS

- A. Reference to a grille means an air supply, exhaust or transfer device without a damper.
- B. Reference to a register means an air supply, exhaust or transfer device with a damper.
- C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.
- D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- E. The capacity and size of the unit shall be as shown on the drawings.
- F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect.

- G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.
- H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.
- I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.
- J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.
- K. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.
- L. Acceptable Manufacturers: Tuttle & Bailey, Titus, Price, Nailor, Carnes, Metalaire, Krueger, Anemostat, Raymon Donco.

2.2 ARCHITECTURAL SQUARE PANEL DIFFUSERS

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10⁻¹² watts with a 10 dB room effect.
- F. Diffusers shall be architectural solid square panel and flush with ceiling.
- G. The exposed surface shall be smooth, flat and free of visible fasteners. The face panel shall be 22 gauge steel with a rolled edge or shall be 18 gauge with a smooth ground, uniform edge.
- H. The back pan shall be one piece 22 gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).
- I. Diffusers with a 24x24 back pan shall have a minimum 18x18 face panel size. Diffusers with a 12x12 back pan shall have a minimum 9x9 face panel size.
- J. The face panel shall be mechanically fastened to the back panel with steel components. (Plastic fasteners are not acceptable.)
- K. Acceptable Manufacturers: Tuttle & Bailey, Titus, Price, Nailor, Carnes, Metalaire, Krueger, Anemostat, Raymon Donco.

2.3 LOUVERS - FIXED - ALUMINUM

- A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be spaced at a maximum of 5.1" apart.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration

when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.

- F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.
- G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- H. Louvers shall be suitable for duct connection.
- I. Acceptable Manufacturers: Air Flow - "EA-403", Arrow - "EA-415-D", American Warming & Ventilating - "LE-21", Construction Specialties - "A4097", Dowco - "DBE-4", Louvers & Dampers, Inc. - "IL-23", Ruskin - "ELF375DX", Vent Products - "2760", Greenheck - "ESD-403", Pottorff - "EFD".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install items in accordance with manufacturers' instructions.
 - 2. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
 - 3. Install diffusers to ductwork with airtight connections.
 - 4. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.
 - 5. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.
- B. Volume Damper:
 - 1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.
- C. Maintaining Duct Cleanliness:
 - 1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 23 05 00.

END OF SECTION

SECTION 23 54 00
FORCED AIR FURNACES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Forced Air Furnaces.
- B. Refrigerant Cooling Coil and Condensing Unit.
- C. Controls.

1.2 QUALITY ASSURANCE

- A. Conform to requirements of UL and applicable codes.
- B. Cooling system tested and rated per AHRI Standard 210.
- C. Conform to ASHRAE 90.1.

1.3 REFERENCES

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. AHRI 210 - Standard for Unitary Air-Conditioning Equipment.

1.4 SUBMITTALS

- A. Submit shop drawings and product data per Section 23 05 00 showing dimensions, connections, arrangement, accessories, and controls.
- B. Submit manufacturer's installation instructions.
- C. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Bryant
- B. Carrier
- C. Lennox

2.2 TYPE

- A. Provide upflow with gas burner and electric refrigeration.
- B. Provide self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter, refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.

2.3 FABRICATION

- A. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- B. Combustion Chamber: Pre-cast refractory.
- C. Supply Fan: Centrifugal type, rubber mounted with direct drive, rubber isolated 1750 rpm, 4-speed motor.
- D. Air Filters: 1" thick glass fiber, disposable type arranged for easy replacement.

2.4 BURNER

- A. Gas Burner: Sealed combustion type, combustion gas valve and pressure regulator incorporating manual shutoff, intermittent spark or glow coil ignition, flame sensing device, and 100% shutoff pilot. 90% minimum efficiency.
- B. Gas Burner Safety Controls: Flame sensor controls open solenoid gas valve upon start. Should loss of flame occur, the controls shall attempt to re-ignite three times before locking the unit out for 60 minutes. The controls shall automatically reset after 60 minutes.

2.5 OPERATING CONTROLS

- A. Provide low voltage, adjustable seven-day programmable room thermostats to control burner operation.
- B. Include thermostat system selector switch (heat-cool-off) and fan control switch (on-auto).
- C. Provide high limit control, with fixed stop at maximum permissible setting, to de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Control supply fan based on bonnet temperature independent of burner controls. Include manual switch for continuous fan operation.

2.6 DRAFT CONTROL

- A. Provide each furnace with PVC combustion air inlet and CPVC outlet piping.
- B. Provide induced draft blower. Pressure switch prove blower operation before allowing gas valve to open. Draft blower shall only operate during heating cycle.

2.7 EVAPORATOR COIL

- A. Mount in furnace supply plenum, copper tube, aluminum fin, coil assembly, and refrigerant piping connections.
- B. Install a drain pan under each cooling coil per ASHRAE 62.1. Extend drain pans the entire width of each coil, including piping and header if in the air stream, and from the upstream face of each coil to a distance 1/2 of the vertical coil height downstream from the downstream face. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.
- C. Provide factory installed thermostatic expansion valve.

2.8 REFRIGERATION PACKAGE

- A. Compressor: Hermetically sealed, 3,600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, hard start kit, motor thermal overload protection, service valves, and drier.
- B. Air Cooled Condenser: Aluminum fin and copper tube coil, direct drive propeller fan resiliently mounted, galvanized fan guard.
- C. Shutter head pressure control for starting and operating down to 45°F.
- D. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

2.9 REFRIGERANT PIPING

- A. Design Pressure: 450 psig.
- B. Maximum Design Temperature: 250 F.

- C. Piping - 4" and under.
 - 1. Tubing: Type ACR seamless copper tube linesets, ASTM B1003. Sizes indicated are nominal designation.
 - 2. Joints: Brazed with silver solder.
 - 3. Fittings: Wrought copper solder joint, ANSI B16.22.
 - 4. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged, and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
- D. Refrigerant linesets are permitted.
 - 1. Provide manufacturer-packaged refrigerant linesets and accessories of sizes needed for installation. Verify lengths of piping required for installation.
- E. Insulation:
 - 1. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Minimum 1/2" thick for pipe sizes < 1-1/4" and 3/4" thick for pipe sizes 1-1/4" and above.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's instructions.

END OF SECTION

SECTION 23 81 26
SPLIT SYSTEM AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Split system air conditioning ceiling-concealed units.

1.2 REFERENCES

- A. ARI 210 - Unitary Air Conditioning Equipment
- B. ARI 240 - Air Source Unitary Heat Pump Equipment
- C. ANSI NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- E. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- F. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- H. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets.
- I. FS TT-C-490 - Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.
- J. UL - Underwriters' Laboratories.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 05 00.
- B. Indicate drain, electrical, and refrigeration rough-in connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Comply with manufacturer's installation instruction for rigging, unloading, and transporting units.
- C. Protect units from weather and construction traffic by storing in dry, roofed location until units are ready for immediate installation.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.
- B. Conform to ASHRAE 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.7 WARRANTY

- A. Provide five (5) year manufacturer's warranty on all compressors.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM WALL AND CEILING-MOUNTED UNITS

- A. Acceptable Manufacturers:
 - 1. Panasonic
 - 2. LG
 - 3. Sanyo
 - 4. Samsung
 - 5. Daikin
 - 6. Mitsubishi
- B. Manufactured Units:
 - 1. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls.
 - 2. Assemble unit for wall-mounted or ceiling installation with service access required.
 - 3. Performance shall be as scheduled on the drawings.
 - 4. Unit shall be rated per AHRI Standards 210/240 and listed in the AHRI directory as a matched system.
 - 5. Provide unit with factory-supplied cleanable air filters.
 - 6. The units shall be listed by Electrical Laboratories (ETL) in accordance with UL-1995 certification and bear the ETL label.
 - 7. All wiring shall be in accordance with the National Electric Code (NEC).
- C. Evaporator Cabinet and Frame:
 - 1. Cabinet:
 - a. Refer to schedule on drawings for mounting type (ceiling concealed).
- D. Evaporator Fans and Motors:
 - 1. Fans:
 - a. The evaporator fan shall be direct drive with a single motor having permanently lubricated bearings.
 - b. The fan shall be statically and dynamically balanced.
 - c. The indoor fan shall have at least three speeds.
 - 2. Motor:
 - a. Direct driven, digitally controlled with multiple speeds. Permanently lubricated with internal overload protection.
- E. Evaporator Coils (Direct Expansion):
 - 1. Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins.
 - 2. Single refrigeration circuit with externally equalized expansion valve.
 - 3. Coils shall be pressure tested at the factory.
 - 4. A sloped, corrosion-resistant condensate pan with drain shall be provided under the coil.
- F. Electrical Panel:
 - 1. Service Connections, Wiring, and Disconnect Requirements: Conform to the National Electrical Code and local electrical codes.

G. Control:

1. The unit shall have a hard-wired wireless 7-day programmable remote controller to operate the system. Provide wall mounting bracket for controller.
2. Remote controller shall have "automatic", "dry" (dehumidification), and "fan only" operating modes.
3. The remote controller shall have the following features:
 - a. *On/Off* power switch.
 - b. *Mode Selector* to operate the system in auto, cool, heat, fan, or dehumidification (dry) operation.
 - c. *Fan Setting* to provide multiple fan speeds.
 - d. *Swing Louver* for adjusting supply louver discharge.
 - e. *On/Off Timer* for automatically switching the unit off or on.
 - f. *Temperature Adjustment* allows for the increase or decrease of the desired temperature.
 - g. *Powerful Operation* to allow quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time.
4. The remote controller shall perform fault diagnostic functions that may be system related, indoor or outdoor unit related depending on the fault code.
5. Temperature range on the remote controller shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
6. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote controller.

H. Outdoor Unit:

1. General:
 - a. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.
2. Cabinet:
 - a. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.
3. Fan:
 - a. The fan shall be direct drive, propeller type fan with fan guard.
 - b. Fan blades shall be statically and dynamically balanced.
 - c. The fan shall have permanently lubricated type bearings.
 - d. Motor shall be protected by internal thermal overload protection.
 - e. Airflow shall be horizontal discharge.
4. Coil:
 - a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
 - b. The coil shall be protected with an internal guard.
 - c. Refrigerant flow from the condenser shall be controlled via a metering device.

5. Compressor:
 - a. Hermetic or scroll refrigerant compressors with resilient suspension system, oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.
 - b. The outdoor unit shall have an accumulator and four-way reversing valve.
6. Refrigerant:
 - a. Unit shall use R-410a.
 - b. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.
- I. Refrigerant Piping:
 1. Design Pressure: 450 psig.
 2. Maximum Design Temperature: 250 F.
 3. Piping - 4" and under.
 - a. Tubing: Type ACR seamless copper tube linesets, ASTM B1003. Sizes indicated are nominal designation.
 - b. Joints: Brazed with silver solder.
 - c. Fittings: Wrought copper solder joint, ANSI B16.22.
 - d. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged, and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
- J. Piping – 1-3/8" and Under (Contractor's Option):
 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 2. Joints: Dual concentric crimp band mechanical press connection.
 3. Fittings: Refrigerant grade copper in accordance with ASTM B75 or ASTM B743 with embedded HNBR O-ring.
 4. Acceptable Manufacturers: Parker Zoomlock
- K. Piping – 1-3/8" and Under (Contractor's Option):
 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
 2. Joints: Mechanically attached connector, axially swaged compression connection.
 3. Fittings: Refrigerant grade copper in accordance with ASTM B75 or ASTM B743. Brass body with two stabilization inserts in accordance with ASTM B15/B16M, two steel rings in accordance with ASTM A108-13, anaerobic adhesive sealant.
 4. Acceptable Manufacturers: Anvil Vulkan Lokring
 5. Refrigerant linesets are permitted.
 - a. Provide manufacturer-packaged refrigerant linesets and accessories of sizes needed for installation. Verify lengths of piping required for installation.
 6. Insulation:
 - a. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Minimum 1/2" thick for pipe sizes < 1-1/4" and 3/4" thick for pipe sizes 1-1/4" and above.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that proper power supply is available.

3.2 INSTALLATION

- A. General Installation Requirements:
 - 1. Install units in accordance with manufacturer's instructions. Install all units level and plumb. Indoor units shall be installed using manufacturer's standard mounting hardware securely fastened to building structure.
 - 2. Coordinate the exact mounting location of all indoor and outdoor units with architectural and electrical work. Coordinate installation of ceiling-mounted units with ceiling grid layout. Provide additional ceiling grid reinforcement or modification as required and coordinate the work with the GC. Locate the indoor unit where it is readily accessible for maintenance and filter changes. Where outdoor units are located on the roof, locate at least 10' from the roof edge.
 - 3. Verify locations of wall-mounted remote controllers with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".
- B. Condensate Removal:
 - 1. Install condensate piping with trap and route from drain pan to nearest drain. Discharge to nearest code-approved receptor or to a properly vented indirect waste fitting. Flush all piping before making final connections to units.
- C. Comb all coils to repair bent fins.
- D. Install new filters in the unit at Substantial Completion.
- E. A factory-authorized service agent shall assist in commissioning the unit and inspecting the installation prior to startup. Submit startup report with O&M manuals.

3.3 REFRIGERANT PIPING

- A. Install refrigerant piping from the indoor unit(s) to the condensing unit. Refrigerant pipe sizes, lengths, specialties and configurations shall be as recommended by the manufacturer. Evacuate refrigerant piping and fully charge system with refrigerant per manufacturer's requirements.
- B. Provide weather-tight insulated roof curb to accommodate refrigerant piping and conduit roof penetrations.
- C. Insulate all refrigerant piping. Both liquid and suction lines shall be insulated between the indoor and outdoor units.
- D. Joining of Piping:
 - 1. Brazed Joints:
 - a. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
 - b. Flux shall conform to ANSI/AWS A5.31.
 - c. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°F.

2. Mechanical Press Connection:
 - a. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
 - b. Examination: Upon delivery to the jobsite, examine copper tubing and fittings for debris, defects, incise marks (manufacturer's engraving on tube), holes, or cracks.
 - c. Fully insert tubing into the fitting and mark tubing.
 - d. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
 - e. Joint shall be pressed with a tool approved by the manufacturer.
 - f. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.
3. Axially Swaged Connection:
 - a. Brass axially swaged connectors shall be installed in accordance with the manufacturer's installation instructions.
 - b. Installers shall be trained by a certified Vulkan LOKRING trainer. Provide proof of certification upon request.

E. Insulation:

1. Insulate all refrigerant pipes between the heat pump and indoor units. This includes the liquid pipe, the suction pipe, the hot gas pipe, and the high/low pressure gas pipe. All fittings, valves, and specialty refrigerant components in the piping between the indoor and heat pump units shall also be insulated. The insulation shall have a continuous vapor barrier and shall pass through hangers and supports unbroken. All exterior insulated piping shall be painted with minimum of one (1) coat of UV resistant paint. Over size hangers and supports to allow the insulation to pass through unbroken. Following are the minimum insulation thicknesses unless noted otherwise in the manufacturer's literature or required by local AHJ:

ASHRAE 2016	
Pipe System	Insulation Thickness
Refrigerant Suction (40°F & Below) Up to 1" 1" and up	1/2" 1"
Refrigerant Suction (41°F to 60°F) Up to 1-1/2" 1-1/2" and up	1/2" 1"
Refrigerant Low Pressure Gas (141°F/61°C-200°F/93°C) Up to 1-1/2" 1-1/2" and up	1-1/2" 2"

ASHRAE 2016	
Pipe System	Insulation Thickness
Refrigerant Liquid	
Up to 1-1/2"	1"
1-1/2" and up	1-1/2"

END OF SECTION

SECTION 23 82 00
TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electric Unit Heaters.

1.2 QUALITY ASSURANCE

- A. All electrical equipment shall have a UL label.
- B. Factory wired equipment shall conform to ANSI/NFPA 70.

1.3 REFERENCES

- A. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00.
- B. Submit catalog data including arrangements, cross sections of cabinets, grilles, bracing, typical elevations.
- C. Indicate mechanical and electrical service locations and requirements. Show deviations from scheduled products.
- D. Submit manufacturers' installation instructions.
- E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.6 REGULATORY REQUIREMENTS

- A. Conform to ASHRAE 90.1.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data. Include operating, installation, maintenance and repair data, and parts listings.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

- A. Horizontal or vertical discharge as scheduled on the drawings.
- B. Horizontal units shall have adjustable outlet louvers.
- C. Metal sheathed fin tube electric heating elements.
- D. Casing: Heavy gauge steel with baked enamel finish.
- E. Automatic reset thermal overload wired for instantaneous pilot operation of contactor holding coil.
- F. Motors shall be totally enclosed continuous duty with built-in thermal overload protection.
- G. Provide unit mounted and wired disconnect.
- H. Provide resiliently mounted fan guard/motor support.

- I. Fans: Direct drive propeller type, factory balanced.
- J. Acceptable Manufacturers: Trane, Chromalox, Modine, Reznor, Berko, Redd-i.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 - 1. Install all products per manufacturers' instructions.
 - 2. Coordinate recess sizes for recessed equipment.
 - 3. Protect units with protective covers during construction.
 - 4. Comb all coils to repair bent fins.
- B. Unit Heater:
 - 1. Hang unit heaters from building structure, not from piping. Mount as high as possible within manufacturer's recommended mounting height requirements. If unit heaters cannot be installed within manufacturer's recommended range, notify Architect/Engineer prior to mounting.

3.2 CLEANING

- A. After construction is complete, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, with materials furnished by manufacturer.

END OF SECTION

SECTION 26 05 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 05 28. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.3 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make his portion of the Electrical Work a finished and working system.
- C. Description of Systems shall be as follows:
 - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
 - 2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
 - 3. Grounding system.
 - 4. Fire alarm system.
 - 5. Wiring system for temperature control system as shown on the drawings.
 - 6. Wiring of equipment furnished by others.
 - 7. Technology Systems as described in Division 27/28 and on the T-series documents as described in the Suggested Matrix of Scope Responsibility.
- D. Work Not Included:
 - 1. Telecommunications cabling will be by Division 27, in raceways and conduits furnished and installed as part of the Electrical work.
 - 2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.4 OWNER FURNISHED PRODUCTS

- A. The Owner will supply manufacturer's installation data for new equipment purchased by him for this project.
- B. This Contractor shall make all electrical system connections shown on the drawings **or** required for fully functional units.
- C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.5 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.
- B. Itemize all work and list associated hours and pay scale for each item.

1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, AND CONTROL CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 - 1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
 - 2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
 - 3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
 - 4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
 - 5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 - 6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
 - 7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
 - 8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
 - 9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.

10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of Regulation Title 24, Article E725.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Luminaires.
 - b. Gravity flow piping.
 - c. Sheet metal.
 - d. Cable trays, including access space.
 - e. Other piping.
 - f. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

- E. Temperature Control Contractor's or Subcontractor's Responsibility:
1. Wiring of all devices needed to make the Temperature Control System functional.
 2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
 3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
- F. Electrical Contractor's Responsibility:
1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
 2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
 3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
 4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- G. General (Electrical/Technology):
1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
 2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
 3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
 4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
 5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

- H. Technology Contractor's Responsibility:
1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
 2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
 3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
 4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.7 QUALITY ASSURANCE

- A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:
1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
 2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.
- B. Qualifications:
1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
 2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City of Colfax, Iowa Codes, Laws, Ordinances and other regulations having jurisdiction.
 2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
 3. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.

4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
 5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
 6. If there are no local codes having jurisdiction, the current issue of the NEC shall be followed.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
 3. Pay all charges for permits or licenses.
 4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
 5. Pay all charges arising out of required inspections by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
 7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
- E. Utility Company Requirements:
1. Secure from the private or public utility company all applicable requirements.
 2. Comply with all utility company requirements.
 3. The Owner shall make application for and pay for new electrical service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and Utility Company.
 4. Furnish the meter socket metering. Verify approved manufacturers and equipment with the Utility Company.
 5. The Owner shall apply and pay for any changes for removal of existing electrical service by the utility company. The Contractor shall verify approved manufacturers and equipment with the Utility Company.
- F. Examination of Drawings:
1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
 3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
 4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
 7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
 8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
 9. Any item listed as furnished shall also be installed unless otherwise noted.
 10. Any item listed as installed shall also be furnished unless otherwise noted.
- G. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
 5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
 6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
 7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
 8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.
- H. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.8 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced	
Specification	
<u>Section</u>	<u>Submittal Item</u>
26 09 33	Lighting Control System
26 24 16	Panelboards
26 24 19	Motor Control
26 28 16	Disconnect Switches
26 28 21	Contactors
26 43 00	Surge Protection Devices
26 51 19	LED Lighting
28 31 00	Fire Alarm and Detection Systems

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain

items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

- c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
- 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
- 5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
- 6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.

- d. All marks and identifications on the submittals shall be unambiguous.
 - 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 - 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 - 9. Reproduction of contract documents alone is not acceptable for submittals.
 - 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
 - 11. Submittals not required by the contract documents may be returned without review.
 - 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 - 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 - 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
- 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 26 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
 - 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.9 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 - 2. Submit in Excel format.
 - 3. Support values given with substantiating data.

- C. Preparation:
 - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 - 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 - 1. Indicated by Architect/Engineer.
 - 2. Change of subcontractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.10 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING AND MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Keep all materials clean, dry and free from damaging environments.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.13 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents

excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.14 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fit in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on his part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with his work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.

2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. No rubbish or waste material is permitted for fill or backfill.
 2. Furnish all necessary sand for backfilling.
 3. Dispose of the excess excavated earth as directed.
 4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
 5. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
 6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
 7. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
 8. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
 9. Backfill with sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
 10. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
 11. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
 12. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.
- F. Surface Restoration:
1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
 2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation:
 - 1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
 - a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
 - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
 - c. Luminaire whips are supported above the ceiling.
 - d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
 - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
 - f. All wall penetrations have been sealed.
 - 2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
 - 3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
 - 4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

- C. The following must be submitted before Architect/Engineer recommends final payment:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up or reproducible drawings and specifications.
 - 3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
 - 4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Architect/Engineer.
 - 5. Inspection and testing report by the fire alarm system manufacturer.
 - 6. Start-up reports on all equipment requiring a factory installation or start-up.
- D. Circuit Directories:
 - 1. Provide custom typed circuit directory for each branch circuit panelboard. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
 - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 - 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
 - 1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 - 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div26.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
 - 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
 7. All text shall be searchable.
 8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.
- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
 2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
 3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
 4. Copies of all factory inspections and/or equipment startup reports.
 5. Copies of warranties.
 6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
 7. Dimensional drawings of equipment.
 8. Detailed parts lists with lists of suppliers.
 9. Operating procedures for each system.
 10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
 11. Repair procedures for major components.
 12. Replacement parts and service material requirements for each system and the frequency of service required.
 13. Instruction books, cards, and manuals furnished with the equipment.
 14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
 15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

- D. The instructions shall include:
 - 1. Maintenance of equipment.
 - 2. Start-up procedures for all major equipment.
 - 3. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to the Owner's representative so his representative can be present if desired.
- F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- G. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions, he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement the requirements of Division 1.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.
- C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.
- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect his color preference before ordering.

- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.
- G. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.
- H. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
 - 1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

3.11 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment

operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

3.13 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
4. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
5. Report of instruction of Owner's representative has been submitted as per Section 26 05 00.
6. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
7. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *

**SECTION 26 05 13
WIRE AND CABLE**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits

1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- B. NFPA 70 - National Electrical Code (NEC)
- C. UL 44 - Thermoset-Insulated Wires and Cables
- D. UL 83 - Thermoplastic-Insulated Wires and Cables
- E. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits Larger Than 6 AWG in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600-volt insulation, THHN/THWN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor, unless otherwise noted on the drawings.
- D. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings.
- E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- F. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS:

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
 - 1. Fire alarm
 - 2. Low voltage switching

- B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.
- C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Above Accessible Ceilings:
 - 1. Building wire shall be installed in raceway.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".
- E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.
 - 1. J-hooks

3.2 CONTRACTOR CHANGES

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.15(B)(16) (formerly 310.16 for NEC 2008 and earlier). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.310.15(B)(2)(7) (formerly B.310.7 for NEC 2008 and earlier).
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
- C. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring (<100 volts).

- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per NEC 310. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks and label the spare conductors.
- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.

3.5 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings or permitted in these specifications.

3.6 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.

- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

3.7 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.
- D. Inspect wire and cable for physical damage and proper connection.
- E. Torque test conductor connections and terminations to manufacturer's recommended values.
- F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- G. Protection of wire and cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

- H. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION

SECTION 26 05 17
ELECTRIC HEAT TRACE AND SNOW MELT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Snow and ice melting cables
- B. Controls

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. ASTM 2633 - Standard Test Method for Thermoplastic Insulations
- C. ASTM B193 - Standard Test Method for Resistivity of Electrical Conductor Materials
- D. UL 746B - Polymeric Materials - Long Term Property Evaluations

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 26 05 00.
- B. Product Data: For each type of product indicated.
 - 1. Field Test Reports: Submit written test reports to include test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Submit manufacturer's instructions under provisions of Section 26 05 00.

1.4 COORDINATION

- A. Coordinate installation of snow-melting cable with installation of concrete framework and concrete placement.

1.5 WARRANTY

- A. Provide a five (5) year warranty under provisions of Section 26 05 00.

PART 2 - PRODUCTS

2.1 SNOW AND ICE MELTING CABLES

- A. Self-Regulating Cable:
 - 1. Heat tape shall be meggered prior to paving installation.
 - 2. Provide power connection, end seal, splices and expansion joint kits as required.
 - 3. Each circuit shall be protected by a 30-mA ground-fault protection device. Provide number of breakers based on manufacturer's maximum length for startup at 0°F. Identify breaker in panel directory as "SNOW MELT".
 - 4. **[HT-1]:** Suitable for installation in concrete pavement to melt snow and ice. 45 watts per square foot, 208 V. Cables must be secured to reinforcing steel or mesh. Cable spacing shall not exceed 12". Cables must be installed 1-1/2" to 2" below finished surface.
 - a. Acceptable Manufacturers: Ray-Chem EM2-XR, Chromalox, Thermon.

2.2 CONTROLS

- A. **[SMP-1]:** Snow Melt Distribution and Control Panel with Remote Snow Sensors:
 - 1. Branch circuit and control panel. NEMA 3R/4 enclosure. 208 volt 3 phase 100 - amp main breaker circuit breaker panel with (3) three 40A 3 pole ground fault protection branch breakers. Snow melt control panel with adjustable hold-on timer, automatic/off/manual switch. Provide with remote Class II aerial solid-state

precipitation and temperature sensor and a pavement-mounted snow sensor. Two (10mA) override inputs and four (10mA) contacts to support remote monitoring and control.

2. Approved Manufacturers: Pentair SMPG3 or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surface and substrates to receive heating cables for compliance with requirements for installation, tolerances, and other conditions affecting performance.
 1. Ensure surfaces and pipes in contact with electrical heating cables are free of burrs and sharp protrusions.
 2. Ensure pipe testing is complete.
 3. Ensure surfaces and substrates are level and plumb.
- B. Test cables for electrical continuity before installing.
- C. Test cables for insulation resistance before installing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Verify field measurements are as shown on the Drawings.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. The heating cable shall be protected from where it leaves the pavement to the junction box by installing the cable in rigid metal conduit. Use one conduit for each heating cable.
- C. Avoid crossing expansion, construction, or control joints with heating cables. Provide sufficient slack conductor in expansion loop.
- D. Do not energize cables embedded in concrete, asphalt, or plaster until those assemblies are cured, except for brief testing.
- E. Install cables after applying bituminous binder course to lower base. Ensure that second labeling bituminous binder is applied to cables before pouring finish topping.
- F. Provide labeling in paving where snow melt cables are present. A metal plate or stamp used prior to concrete setting must contain the name of the snow melt company, the word "CAUTION", the phrase "EMBEDDED SNOW MELTING SYSTEM", and the date the system was installed. The labeling of the system must be able to handle the outdoor environment without degrading.

3.3 CONNECTIONS

- A. Cable splices and repairs shall be made using a splice kit provided by the manufacturer and specifically designed for that purpose.
- B. Power connection and end seal junction box shall be mounted above grade. The junction box shall be installed in such a way so that water cannot enter it.

3.4 FIELD QUALITY CONTROL

- A. Inspect cable for physical damage before installation.
- B. Test cables for electrical continuity before energizing.
- C. Test cables for insulation resistance before energizing. Remove cables if measured resistance is less than 10 megohms to ground.
- D. Repeat test for continuity and insulation resistance after applying paving or thermal insulation.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 Grounding and Bonding Equipment.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- D. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.4 SUMMARY

- A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Hydraulic compression type, in kit form, and selected per manufacturer's written instructions.
- C. Bolted Connectors: Bolted-pressure-type connectors.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4" in diameter by 120 inches per section.
- B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

PART 3 - EXECUTION

3.1 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- F. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.
- G. Underground Connections: Hydraulic compression connection. Use for underground connections, except those at test wells.
- H. Connections at Test Wells: Use compression-type connectors on conductors and make two bolted- and clamped-type connections between conductors and ground rods.
- I. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity.

- J. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- K. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.2 INSTALLATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.
- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. In raceways, use insulated equipment grounding conductors.
- F. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- G. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

3.3 EQUIPMENT GROUNDING SYSTEM

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.4 BONDING SYSTEM

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Exterior Metallic Pull and Junction Box Covers, Metallic Handrails: Bond to grounding system using flexible grounding conductors.
- C. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and

air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.

- D. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.
- E. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.
- G. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
- H. Terminal Cabinets: Terminate bonding conductor on cabinet grounding terminal.
- I. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.

3.5 GROUNDING ELECTRODE SYSTEM

- A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- B. Provide bonding at Utility Company's metering equipment and pad mounted transformer.
- C. Ground Rods: Install at least two rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond each aboveground portion of natural gas metallic piping system at equipment locations. The equipment grounding conductor may serve as the bonding means.

3.6 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
 - 1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.

END OF SECTION

SECTION 26 05 27
SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment support
- B. Fastening hardware

1.2 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 COORDINATION

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Allied Support Systems
- B. Cooper B-Line
- C. Erico, Inc.
- D. Hilti
- E. Power Fasteners
- F. Orbit Industries

2.2 MATERIAL

- A. Support Channel: Hot-dip galvanized for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
 - 1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
 - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
 - 2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
 - 3. Welding Lugs: Comply with MSS-SP-69, Type 57.
 - 4. Beam clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
 - 5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings and matched to the type and size of anchor bolts and studs used.
 - 6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings and matched to the type and size of attachment devices used.
 - 7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- D. Rooftop Support System:
 1. Provide prefabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
 2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
 3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
 4. Acceptable Products: Anvil International HBS-Base Series, Cooper B-Line Dura-Blok, Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- D. Do not use powder-actuated anchors without specific permission.
- E. Do not drill structural steel members.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- G. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.
- H. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting.
- I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- J. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- K. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION

SECTION 26 05 33
CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Electrical metallic tubing and fittings (EMT)
- C. Flexible metallic conduit and fittings (FMC)
- D. Liquidtight flexible metallic conduit and fittings (LFMC)
- E. Rigid polyvinyl chloride conduit and fittings (PVC)
- F. Wall and ceiling outlet boxes
- G. Electrical connection
- H. Pull and junction boxes
- I. Accessories

1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
 - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
 - 4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
 - 5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
 - 1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
 - 2. A-A-55810 - Specification for Flexible Metal Conduit
- C. NECA "Standards of Installation"
- D. National Electrical Manufacturers Association (NEMA):
 - 1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 - 2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
 - 3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
 - 4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation
- E. NFPA 70 National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
 - 1. UL 1 - Flexible Metal Conduit
 - 2. UL 6 - Rigid Metal Conduit

3. UL 360 - Liquid Tight Flexible Steel Conduit
 4. UL514-B - Conduit Tubing and Cable Fittings
 5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
 6. UL651-B - Continuous Length HDPE Conduit
 7. UL746A - Standard for Polymeric Materials – Short Term Property Evaluations
 8. UL797 - Electrical Metal Tubing
 9. UL1242 - Intermediate Metal Conduit
- G. American Standard of Testing and Materials (ASTM):
1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
 2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
 3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
 4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
 5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
 6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material
- H. Definitions:
1. Fittings: Conduit connection or coupling.
 2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
 3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
 4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
 5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
 6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
 7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

PART 2 - PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

- A. Acceptable Manufacturers:
1. Acceptable Manufacturers: Allied, LTV, Steelduct, Calbond Calpipe, Wheatland Tube Co, O-Z Gedney, or approved equal.

2. Acceptable Manufacturers of RMC Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, Crouse-Hinds, Killark, Orbit Industries or approved equal.
- B. Minimum Size Galvanized Steel: 3/4 inch (19mm), unless otherwise noted.
- C. Fittings and Conduit Bodies:
 1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
 2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
 3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
 4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. **High impact phenolic threaded type bushings are not acceptable.**
 5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.
- D. PVC Externally Coated Conduit: Compliant with NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system. Acceptable Manufacturers: Calbond Calpipe, Robroy, T&B Ocal or approved equal.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers of EMT Conduit: Allied, Calbond Calpipe, LTV, Steelduct, Wheatland Tube Co, or approved equal.
- C. Fittings and Conduit Bodies:
 1. 2" Diameter or Smaller: Compression or steel set screw type of steel designed for their specific application.
 2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
 3. Larger than 2": Compression or steel set screw type of steel designed for their specific application.
 4. Acceptable Manufacturers of EMT Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, Orbit Industries or approved equal.

2.3 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Acceptable Manufacturers: American Flex, Alflex, Electri-Flex Co, or approved equal.
- C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel.

Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:

1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Acceptable Manufacturers: O-Z/Gedney Co., Thomas & Betts, Appleton Electric, Electroline, Bridgeport, Midwest, Regal, Orbit Industries, or approved equal.

2.4 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

- A. Acceptable Manufacturers: Anaconda Type UA, Electri-Flex Type LA, Alfex, Carlon (Lamson & Sessions), or approved equal.
- B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.
- C. Fittings and Conduit Bodies:
 1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 3. Acceptable Manufacturers: Appleton Electric, O-Z/Gedney Co., Electroline, Bridgeport, Thomas & Betts, Midwest, Regal, Carlon (Lamson & Sessions), Orbit Industries, or approved equal.

2.5 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers: Carlon (Lamson & Sessions) Type 40, Cantex, J.M. Mfg., or approved equal.
- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.6 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, minimum of 14 gauge, with 1/2-inch male fixture studs where required.
- B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
- C. Cast Boxes: NEMA FB1, Type FD, Aluminum, cast ferrous alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
- E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls,

boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.

- F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.7 [ECONN]: ELECTRICAL CONNECTION

- A. Electrical connection to equipment and motors, sized per NEC. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.8 [JB]: PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
- E. Flanged type boxes shall be used where installed flush in wall.

2.9 ACCESSORIES

- A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control – IsoBacker Pad, SpecSeal – SSP Putty and Pads, 3M #MPP-4S or equal.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the NEC shall be required.
- B. The following schedule shall be adhered to unless they constitute a violation of applicable codes or are noted otherwise on the drawings. The installation of RMC conduit will be permitted in place of all conduit specified in this schedule.

Installation Type	RMC	IMC	EMT	PVC
Feeders: Switchboards, distribution panels, panelboards, motor control centers, etc.		X	X	
Branch Circuits: Lighting, receptacles, controls, etc.		X	X	
Mechanical Equipment Feeders: Pumps, chillers, air handling units, etc.		X	X	
Floor Mounted Equipment Feeders: Pumps, etc. (include no more than 6 feet of LFMC to pump)		X	X	

Installation Type	RMC	IMC	EMT	PVC
Controls (lighting, power, building automation, etc.)		X	X	
Finished Spaces / Concealed			X	
Wet and Damp Locations: (conduit, boxes, fittings, installed and equipped to prevent water entry)	X			
Elevated Concrete Slabs (above grade)	X			X
Interior Locations: Concealed			X	
Interior Locations: Exposed		X	X	
Interior Locations: Existing walls and exposed installation (finished spaces)			X	

1. Underground / Slabs on Grade:
 - a. In or Under Slabs on Grade:
 - 1) Within 5' from the perimeter of the building: PVC
 - 2) Within 5' from the perimeter of the building when passing through the perimeter of the building foundation: RMC conduit with a minimum of 3" thickness between the surface of the concrete and the nearest conduit. Concrete to be doweled into the foundation.
 - b. Site Conduits:
 - 1) Within 5' from the Perimeter of a Building Foundation: RMC conduit with a minimum of 3" thickness between the surface of the concrete and the nearest conduit. Concrete to be doweled into the foundation.
 - 2) 5' or Greater from the Perimeter of a Building Foundation: PVC.
 - 3) Under Roads, Drives, and Vehicle Traveled Ways: RMC Schedule 40 or Schedule 80 PVC Directional boring: HDPE with pressurized grout backfill with a minimum of 3" concrete cover on all sides of conduit.
 - 4) Reinforcing shall consist of one-half inch deformed bars spaced 12 inches on center, paralleling the ducts on bottom, with one-half inch deformed tie bars spaced twelve inches on centers.
 - 5) Bars shall overlap 40 diameters and shall extend 5' beyond roads, drives, traveled ways, etc.
 - 6) Provide minimum 3" concrete cover on all sides of reinforcing.
- C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to NEC. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the NEC (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- D. Minimum Conduit Size (Unless Noted Otherwise):
 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
 2. Below Grade 5' or less from Building Foundation: 1 inch.
 3. Below Grade More than 5' from Building Foundation: 1 inch.

4. Telecommunication Conduit: 1 inch.
5. Controls Conduit: 1/2 inch.
- E. Conduit Embedded in Slabs above Grade:
 1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
 2. Maximum size 3/4 inch for conduits crossing each other.
- F. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):
 1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
 2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.
- D. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- F. Contractor shall adapt his work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- G. Contractor shall cooperate with all Contractors on the project. He shall obtain details of other Contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by him. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the NEC requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the NEC requirements.
- L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- M. Finish:
 - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
 - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
 - a. A third bend is acceptable if:
 - 1) The total run is not longer than (33) feet.
 - 2) The conduit size is increased to the next trade size.
5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the NEC.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.

3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, equal to O-Z/Gedney type EYD.
9. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
10. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
11. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
12. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
13. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
14. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
15. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.5 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the NEC, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 UNDERGROUND CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
 - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
 - 2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):
 - 1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (>600V) and 18 inches for secondary conduits (<600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Conduit Placement:
 - 1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
 - 2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
 - 3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
 - 4. Before the Contractor pulls any cables into the conduit he shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
 - 5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.

6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
 7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
 8. All non-metallic conduit installed underground outside of a slab shall be rigid.
- E. Horizontal Directional Drilling:
1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
 2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.
- F. Raceway Seal:
1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
 2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" or equivalent duct seal, capable of withstanding a 10-foot head of water (5 PSI).

3.7 BOX INSTALLATION SCHEDULE

- A. Galvanized steel boxes may be used in:
1. Concealed interior locations above ceilings and in hollow studded partitions.
 2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
 3. Direct contact with concrete except slab on grade.
- B. Cast boxes shall be used in:
1. Exterior locations.
 2. Exposed interior locations within 8' of the highest platform level.
 3. Direct contact with earth.
 4. Direct contact with concrete in slab on grade.
 5. Wet locations.

3.8 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.9 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls.
 - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.
- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- M. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- N. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- O. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.10 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls.

2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

3.11 EXPOSED BOX INSTALLATION

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.
- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Adhesive labels, markings, nameplates, and signs
- B. Wire and cable markers
- C. Raceway, box, and wire identification
- D. Equipment short circuit current rating (SCCR) labeling
- E. Electrical equipment labeling
- F. Electrical working clearance identification

1.2 REFERENCES

- A. ANSI C2 - National Electrical Safety Code
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
 - 1. Label Size as follows:
 - a. Raceways: Kroy or Brother labels 1-inch (25mm) high by 12-inches (305mm) long (minimum).
 - 2. Color: As specified for various systems.
- B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch (25mm) to 2 inches (50mm) in width.
- C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch (5mm) minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50°F to 350°F (10°C to 176°C). Provide ties in specified colors when used for color coding.
- F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- G. Aluminum, Wraparound Marker Bands: 1-inch (25mm) width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Brass or aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch (2mm) metal tags with stamped legend, punched for fastener.

- I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- J. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Font: Normal 721 Swiss Bold
 - b. Adhesive Labels: 3/16 inch (5mm) minimum text height
 - c. Vinyl / Plastic Laminate Labels: 3/4" inch (19mm) minimum text height

2.2 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch (2mm) minimum thick for signs up to 20 square inches (13 square cm), or 8 inches (200mm) in length; 1/8 inch (3mm) thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Text Height: 3/8 inch (10mm) minimum
- C. Baked–Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (10mm) galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

- A. Adhesive Markings and Field Labels:
 - 1. All Labels: Black letters on white face
 - 2. Normal Power and General Labels: Black letters on white face
 - 3. Fire Alarm: Red letters on white face
 - 4. Emergency: Red letters on white face
- B. Nameplates and Signs:
 - 1. NORMAL POWER: Black letters on white face
 - 2. Control Labels: Black letters on white face
 - 3. EMERGENCY: White letters on red face
 - 4. GROUNDING: White letters on green face.
 - 5. CAUTION or UPS: Black letters on yellow face
- C. Raceways and Conduit:
 - 1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:
 - a. Normal Power and General Distribution: Silver
 - b. Emergency Power Distribution System:
 - 1) All Emergency: Orange

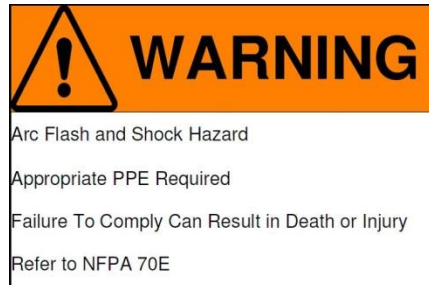
- 2) Legally Required Standby: Yellow
 - 3) Optional Standby: Orange
 - 4) Life Safety and Critical Branch: Yellow
 - 5) Equipment Branch: Orange
- c. Fire Alarm System: Red
- d. Temperature Controls: Refer to mechanical cover sheet for color
- e. Ground: Green
- f. Low Voltage and Telephone: Purple
- D. Box Covers:
 - 1. Box cover colors shall match conduit colors listed above.
- E. Conductor Color Identification: Refer to Part 3 for additional information.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.
- B. Install identification devices in accordance with manufacturer's written instruction and requirements of NEC.
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- D. Circuit Identification: Tag or label conductors as follows:
 - 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
 - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
 - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- E. Apply warning, caution and instruction signs as follows:
 - 1. Install warning, caution or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 - 2. Emergency Operating Signs: Install, where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch (10mm) high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

- F. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- G. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- H. Install ARC FLASH WARNING signs on all panelboards, industrial control panels, and motor control centers. Sign at a minimum shall contain:



- I. Circuits with more than 600V: Identify raceway and cable with "DANGER—HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot (3m) intervals.
 - 1. Entire floor area directly above conduits running beneath and within 12 inches (305mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to conduits concealed within wall.
 - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
- J. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches (405mm); provide a second plastic line marker to mark each edge of the trench when 16 inches (405mm) of width is exceeded. Limit line markers to direct-buried cables. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

3.2 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

- A. Product:
 - 1. Adhesive labels and field markings
- B. Identification material to be a clear, 3/8-inch (10mm) Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.
- C. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.3 BOX LABELING

- A. Products:
 - 1. Adhesive labels and field markings
- B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch (10mm) Kroy tape or Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.

- C. All junction, pull, and connection boxes shall be identified as follows:
 - 1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
 - 2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

3.4 CONDUCTOR COLOR CODING

- A. Products:
 - 1. All wire and cables shall be color coded by the manufacturer.
- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.
- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches (76mm) from the termination and spaced at 3- inches (76mm) centers. Tighten to a snug fit and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
 - 1. 208Y/120 Volt, 4-Wire:
 - a. A-Phase – Black
 - b. B-Phase – Red
 - c. C-Phase – Blue
 - d. Neutral – White
 - e. Ground Bond – Green
 - 2. Grounding Conductors:
 - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
 - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
 - 3. Cabling for Remote Control, Signal, and Power Limited Circuits:
 - a. Fire Alarm: Red.
 - b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
 - c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
 - d. Electronic Control: Per manufacturer recommendations and code requirements.
 - e. Audio/Visual Systems: Refer to Division 27.
 - f. Structured Cabling: Refer to Division 27.

3.5 CONTROL EQUIPMENT IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs

- B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served.
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and phase of circuit(s).
 - 4. Panel and circuit number(s) serving the equipment.
 - 5. Method of automatic control, if included ("AUTO CONTROL BY FCMS").
 - 6. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
 - 7. Date of fault current study, refer to one-line diagram

EXHAUST FAN EF-1
("LOCATED ON ROOF")
480V, 3-PHASE
FED FROM "1HA1-1"
AUTO CONTROL BY FCMS
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.6 EQUIPMENT CONNECTION IDENTIFICATION

- A. Products:
 - 1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
- D. Labeling shall include:
 - 1. Equipment type and contract documents designation of equipment being served
 - 2. Location of equipment being served if it is not located within sight.
 - 3. Voltage and rating of the equipment.
 - 4. Panel and circuit numbers(s) serving the equipment
 - 5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
 - 6. Date of fault current study; refer to one-line diagram

UNIT HEATER UH-1
("LOCATED IN STORAGE ROOM 200")
480V: 3-PHASE
FED FROM "1HA1-1"
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.7 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.

1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
2. Exterior Equipment: The identification material shall be engraved vinyl labels.
3. Labeling shall include:
 - a. Equipment type and contract documents designation of equipment.
 - b. Voltage of the equipment.
 - c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
 - d. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").

DISTRIBUTION PANEL <u>DP-H1</u> 480Y/277V FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:
 - a. Available fault current; refer to one-line diagram or panel schedules
 - b. Date of fault current study; refer to one-line diagram

22,000 AMPS AVAILABLE FAULT CURRENT DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:

1. Nominal system voltage
2. Maximum available fault current; refer to one-line diagram for values
3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 05 73 for value.
4. Date of fault current study; refer to one-line diagram
5. Date of label

480Y/277V 39,800 AMPS AVAILABLE FAULT CURRENT 0.07 SECOND CLEARING TIME DATE OF STUDY: 1 JAN 2017 DATE OF LABEL: 4 JUL 2017

D. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

- E. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1").
- F. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

3.8 ELECTRICAL WORKING CLEARANCE IDENTIFICATION

- A. Products:
 - 1. Safety Yellow paint and custom stencils
- B. Provide custom identification of electrical equipment working clearances in mechanical, electrical, storage, janitorial, and similar non-public areas.
- C. Identification shall include a painted rectangular box (on the finished floor) in front of the electrical equipment to define the code-required working clearance. Provide additional diagonal stripping inside the rectangle box. All painted stripping shall be safety yellow paint with 3 inch (76mm) wide stripes.
 - 1. Width of area: Width of equipment or as required by code
 - 2. Depth of area: Depth as required by code

END OF SECTION

SECTION 26 09 16
ELECTRICAL CONTROLS AND RELAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Relays and Timers

PART 2 - PRODUCTS

2.1 TIME RELAYS

- A. **[R-#]:** Time relays shall be rated and shall be electric type incorporating mode of on delay. Time period shall be adjustable.
- B. Time relays shall be mounted in NEMA 1 enclosures in control terminal cabinet.
- C. Approved Manufacturers: Square D Class 9050 Type RE7, Cutler Hammer, General Electric, Siemens.

2.2 [CPC]: CONTROL POWER CABINET

- A. 1800 VA power supply with 1 isolated 24 VAC 360 VA Class II secondaries. 120 VAC primary. Secondary circuit breakers, manual switch and indicator light. 12"x12"x6" screw cover NEMA 1 steel enclosure. Power on indicator light. Equipment for interface of temperature control system. Mount as shown on drawings. Refer to detail 7/E301 for layout, wiring and components.
 - 1. Approved Manufacturers: Functional Devices, Inc. PSH500A PSH300A.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate with Mechanical Division 23 in connection of control conduit into control terminal cabinet.
- B. Install line voltage thermostats for single phase motors. provided by Division 21/22/23.
- C. Provide remote control connection to remote devices.

END OF SECTION

SECTION 26 09 33
LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Line and low voltage standalone lighting controls
- B. Distributed lighting control
- C. Time switches

1.2 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
 - 1. 26 51 19 LED Lighting
 - 2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details

1.3 RELATED WORK

- A. Section 26 51 00 - Lighting

1.4 QUALITY ASSURANCE

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
- C. Comply with NEC as applicable to electrical wiring work.
- D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.
- F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.5 REFERENCES

- A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
- B. FS W S 896 Switch, Toggle
- C. International Energy Conservation Code (IECC)
- D. NEMA WD 1 - General Color Requirements for Wiring Devices
- E. NEMA WD 7 - Occupancy Motion Sensors
- F. NFPA 70 - National Electrical Code (NEC)
- G. UL Standard 916 Energy Management Equipment

- H. UL 924 - Emergency Lighting and Power Equipment
- I. UL 1472 - Solid-State Dimming Controls

1.6 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.
- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.

1.7 EXTRA STOCK

- A. Provide extra stock under provisions of Section 26 05 00.
- B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Section 26 05 00.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:
 - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
 - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
 - 3. Replacement part numbers for all system components.
- B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

1.10 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor

and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.

- B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.
 - 1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
 - 2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown but shall be submitted with the shop drawings.
- C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.
 - 1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
 - 2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.
 - a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.

1.11 WARRANTY

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROLS

- A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications.
- B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.
- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

2.2 LIGHTING CONTROL STATION

- A. **[SW]** The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.
 - 1. In spaces where the wall control station is shown in multiple locations, the sequence of operation shall be the same at all locations, unless noted otherwise.
 - 2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

2.3 DEVICE COLOR

- A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

2.4 COVERPLATES

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

2.5 WALL SWITCHES

- A. Refer to Electrical Symbols List for device type.
- B. **[SW-1P]:** Single Pole Switch:
 - 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
 - 2. Approved Manufacturers: Hubbell HBL1221, Leviton 1221-2, Pass & Seymour PS20AC1, Cooper AH1221.
- C. **[SW-3W]:** Three-way Switch:
 - 1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
 - 2. Approved Manufacturers: Hubbell 1223, Leviton 1223-2, Pass & Seymour PS20AC3, Cooper AH1223.

2.6 WALL DIMMERS

- A. UL listed with integral air-gap switch for on/off control.
- B. Integral EMI/RFI suppression.
- C. Non-viewable heat sink.
- D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.
- E. Dimmer to match device color.
- F. **[SW-D-LED]:** LED Electronic Driver Dimmer:
 - 1. 120 -volt, decora style linear slider operator with positive off. Color to match adjacent devices. Luminaire manufacturer shall list compatible dimmer manufacturers and models. 0-10V dimmers shall comply with IEC 60629 Annex E.
 - 2. Approved Manufacturers: Compatible with provided LED driver.
 - 3.
- G. **[SW-D3-LED]:** LED Electronic Driver Three-Way Dimmer:
 - 1. 120-volt, decora style linear slider operator with positive off. Color to match adjacent devices. Luminaire manufacturer shall list compatible dimmer manufacturers and models. 0-10V dimmers shall comply with IEC 60929 Annex E.
 - 2. Approved Manufacturers: Compatible with provided LED driver.

2.7 LOCAL DAYLIGHTING CONTROLS

A. Standalone Interior Photo Sensors:

1. **[SW-LS-D]:** Daylight Level Sensor and Controller - 0-10V Dimming - One Zone:
 - a. Dimming control of one 0-10V zone. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinated with dimming ballast prior to submittal.
 - b. Approved Manufacturers: Watt Stopper LS-301, Hubble Automation DLC7, Sensor Switch N-CMADC.
2. Sensor shall detect changes in ambient light level and provide triggering of lighting groups in area based on sequence of operation.
3. Sensor shall be configurable via DIP switches at device or via handheld wireless remote programming unit. Settings shall include:
 - a. Ambient sensitivity range between 1 and 1,000 foot-candles.
 - b. Time delay of 5 to 300 seconds.
 - c. Trigger setpoints with deadband adjustment.
4. Sensor shall provide on/off setpoints in quantity as specified on drawings and as shown in the sequence of operation.
5. Sensor shall be ceiling- or wall-mounted for range and viewing angle meeting application requirements as outlined in the sequence of operation.
6. Output signal from sensor shall be linear with light level.

B. **[SW-LS-PC]:** Standalone Exterior Photo Sensors:

1. Sensor shall be within a weatherproof enclosure, with design operation in temperatures of -30°F to +130°F. Sensor shall have threaded stem for box mounting, with knuckle to permit aiming of receptor after installation. Sensor shall be mounted facing north.
2. Sensor shall contain an integral switching contactor rated for 277-volt operation, with loads of up to 1,800 VA. Contacts shall be configured for zero-crossing closure to provide 100,000 cycle minimum operation.
3. Sensor shall detect changes in daylight levels to provide triggering of exterior lighting equipment based on the sequence of operation.
4. Sensor shall be field configurable at the device or via handheld wireless remote controller. Configurable settings shall include:
 - a. Ambient sensitivity range of 5 to 1,500 foot-candles.
 - b. Adjustable setpoint.
 - c. Deadband adjustment by percentage of setpoint.
 - d. Time delay of up to five minutes.
5. Sensor shall be equipped with a lens cover that can be applied for system testing during daylight conditions.
6. Approved Manufacturers: Paragon, Tork, Intermatic.

2.8 INDOOR OCCUPANCY AND VACANCY SENSORS

A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a

- manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
 - c. Time Delay and Sensitivity Adjustments: Recessed and concealed.
 5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Power Supply and Slave Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
 8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
 9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
 10. Warranty: Five (5) year warranty.
- B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. **[SW-VS-D] or [SW-OC-D]:** 360 Degree Coverage Pattern:
 - a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay, integrated isolated relay contact. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.
 - b. Approved Manufacturers: Watt Stopper DT 300 Series, Hubbell OMNI-DT2000 or ATD2000C, Greengate OAC-DT, Leviton OSC##-MOW, Sensor Switch CM PDT 10.
 2. **[SW-O]:** Wall Switch:
 - a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
 - b. Approved Manufacturers: Watt Stopper DW-100 Series, Hubbell LHMTS, Leviton OSSMT series, Sensor Switch WSD-PDT SA Series.
 3. Sensitivity Adjustment: Separate for each sensing technology.

4. Detection Coverage:
 - a. Task Areas: Detect occupancy anywhere in an area based on hand motion.
 - b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.
- C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.
- D. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.
 1. **[SW-O]:** Wall Switch Occupancy Sensor:
 - a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (10 to 150 FC range), adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
 - b. Approved Manufacturers: Watt Stopper PW-100 Series, Sensor Switch WSX, Hubbell LHIRS1 or AP1277, Leviton ODS15, Greengate OSW-P-0451.
- E. Ultrasonic Type: Ceiling mounting. Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
 1. **[SW-OC-U]:** 360 Degree 20' x 20' Hand Motion Coverage Pattern:
 - a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated 1-amp relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
 - b. Approved Manufacturers: Watt Stopper WT-1100 series, Hubbell OMNI-US or ATU series, Leviton OSC series, Greengate ODC-U series.
 2. Crystal controlled with circuitry that causes no detection interference between adjacent sensors.

2.9 DISTRIBUTED LIGHTING CONTROL

- A. Acceptable manufacturers as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.
 1. Acuity Controls nLight Series
 2. Legrand Watt Stopper DLM Series
 3. Hubbell Automation NX Series
 4. Eaton Greengate RC3 Series (room-based system)
 5. Osram Encelium Series
 6. Lutron
- B. System Description: The lighting control system shall be a network of remote modules. System includes all associated wiring, relay modules, photocells, switches, dimmers, time clock, occupancy sensors. System shall utilize distributed relays modules, allowing these relay modules to be located above accessible ceilings in or adjacent to rooms they are controlling.
- C. Control Devices: All occupancy sensors (ultrasonic, IR and dual technology type), photocells, switches, and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.

- D. Relay Modules: Mounted in NEMA enclosure with physically separate 120/277-volt wiring compartment from low voltage control wiring. Provide low voltage digital communication to control devices as shown on drawings and schedules. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission. Dimmable relay modules shall be provided where indicated. Relay modules shall contain up to four (4) relays. Relay modules shall be labeled with room number that relays control lighting within.
- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-volt AC for tungsten filaments and 20 A, 277-volt AC for electronic ballasts, 50,000 cycles at rated capacity.

2.10 TIME SWITCH

- A. **[TC-30]:** Time switch, 7-day, electronic, 30 setpoints available, LCD display, 12 or 24-hour format, minimum 200 hours battery backup, one SPDT 15-amp contact, UL listed.
 - 1. Approved Manufacturers: Paragon EC71/30S, Tork EW101S, Intermatic ET70115C.

2.11 CONDUCTORS AND CABLES

- A. Control Wiring:
 - 1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No. 16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 26 05 13 "Wire and Cable."
 - 2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
 - 3. Tap conductors to dimming ballasts: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
 - 4. Network cabling as required by manufacturer.
- B. Splices and Taps:
 - 1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. All wiring shall be installed in conduit.
- C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

3.3 SUPPORT SERVICES

A. System Startup:

1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.

B. Testing:

1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming. However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
 - a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
 - b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
 - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
 - a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
 - b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

C. Training:

1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.

END OF SECTION

**SECTION 26 20 00
SERVICE ENTRANCE**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Arrangement with Utility Company for permanent electric service
- B. Underground service entrance

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram for additional information.

1.3 QUALITY ASSURANCE

- A. Utility Company: MidAmerican Energy.
- B. Contact: Tim Davis.
- C. Install service entrance in accordance with Utility Company's rules and regulations.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Submit Utility Company prepared drawings (if applicable).

1.5 SYSTEM DESCRIPTION

- A. System Voltage: 208Y/120 volts, three phase, four-wire, 60 Hertz.

PART 2 - PRODUCTS

2.1 METERING EQUIPMENT

- A. Meter: Furnished by the Utility Company.
- B. Meter Base: Furnished by the Contractor, as approved by the Utility Company. (Manufacturers: Milbank, Superior, Duncan, or Anchor).

2.2 IDENTIFICATION

- A. Provide a permanent plaque or sign denoting all services, feeders, and branch circuits supplying the building or structure and the area served by each. Install plaque or sign at each service disconnecting means.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Primary distribution equipment and pole-mounted transformers shall be furnished and installed by the Utility Company.
- C. Primary conductors shall be furnished, installed, and terminated by the Utility Company. Primary conduit shall be furnished and installed by the Contractor, as shown on the drawings, to the Utility Company's requirements.
- D. Underground: Install service entrance conduits in concrete envelope from Utility Company's pad mounted transformer to meter cabinet and building service entrance equipment. Utility Company will connect service conductors to transformer secondary lugs.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lighting and appliance branch circuit panelboards: **[Panel '###']**

1.2 RELATED SECTIONS AND WORK

- A. Refer to the One-Line Diagram and Panel Schedules for size, rating, and configuration.

1.3 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA FU 1 - Low voltage cartridge fuses
- C. NEMA KS 1 - Enclosed Switches
- D. NEMA PB 1 - Panelboards
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- F. UL 67 - Panelboards

1.4 SUBMITTALS

- A. Submit shop drawings for equipment and component devices under provisions of Section 26 05 00.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Selective coordination study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.

1.5 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.

PART 2 - PRODUCTS

2.1 RATINGS

- A. Definitions:
 - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 05 53 for additional requirements.
 - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 BRANCH CIRCUIT PANELBOARDS

- A. General
 - 1. Approved Manufacturers:
 - a. Square D NQ, NF
 - b. General Electric AQ, AE
 - c. Siemens P1
 - d. Cutler Hammer PRL1, PRL2

- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike Hinged trim shall be secured with screws. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.
- J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.
- B. Height: 6 feet to handle of highest device.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide custom typed circuit directory for each branch circuit panelboard. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.
- E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Device plates and box covers
- B. Receptacles
- C. Floor boxes

1.2 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC Article 100, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the NEC.

1.3 REFERENCES

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 6 - Wiring Devices – Dimensional Requirements
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL 498 - Standard for Attachment Plugs and Receptacles
- G. UL 943 - Standard for Ground Fault Circuit Interrupters

1.4 COORDINATION

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

- A. All switch, receptacle, outlet, and coverplate colors shall be verified with Architect, unless indicated otherwise.

2.2 COVERPLATES

- A. All switches, receptacles, and outlets shall be complete with the following:
 - 1. Unbreakable thermoplastic/thermoset plastic coverplates in finished spaces where walls are finished.
 - 2. #302 stainless steel coverplates in unfinished spaces for flush boxes.
 - 3. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.3 RECEPTACLES

- A. Refer to Electrical Symbols List for device type.
- B. **[REC-DUP]:** NEMA 5-20R Duplex Receptacle:
 - 1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.

2. Approved Manufacturers: Hubbell 5352A, Leviton, 5362-S, Pass & Seymour 5362, Cooper 5352.
- C. **[REC-DUP-GFI]:** NEMA 5-20R Ground Fault Duplex Receptacle:
 1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face.
 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 3. Approved Manufacturers: Hubbell GF20L, Leviton GFNT2, Pass & Seymour 2097, Cooper SGF20.
- D. **[REC-DUP-WP]:** NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:
 1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face. Provide NEMA 3R rated while-in-use clear cover.
 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 3. Approved Manufacturers: Hubbell GFTR20/(RW57300) WP826, Leviton GFWT2/(5977-CL) M5979, Pass & Seymour 2097TRWR/(WIUC10-C) WIUCAST1, Cooper WRS GF20/(WIU-1) WIUMV-1.
- E. **[REC-QUAD]:** NEMA 5-20R Double Duplex Receptacle:
 1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.
 2. Approved manufacturers: Refer to Duplex Receptacle above.
- F. **[REC-QUAD-GFI]:** NEMA 5-20R Double Duplex GFI Receptacle:
 1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.
 2. Approved Manufacturers: Refer to Duplex GFI Receptacle above.
- G. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
- H. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- I. Ground fault circuit interrupter (GFCI) receptacles shall comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

2.4 FLOOR BOXES

- A. Color: Verify with Architect.
- B. Coordinate with Technology drawings for voice/data outlet requirements.
- C. Floor Boxes for Installation in Wood Floors: Fully adjustable.
- D. **[FB-#]:** Recessed multi-service floor box - tele/power/data. Equivalent mounting space of four (4) single gang boxes consisting of one (1) **[REC-DUP]**, one (1) voice outlet, one (1) data outlet, and one (1) spare. Adjustable rectangular floor box with cover. Provide one (1) 1" conduit for information outlet cabling, one (1) 1" conduit for audio/visual cabling, and one (1) 1" conduit as spare. Route low voltage cabling conduits to above the lay-in ceiling or the corridor cable tray.
 1. Approved Manufacturers:
 - a. Wiremold
 - b. Steel City
 - c. Hubbell

2.5 INSTALLATION

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.
- D. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- E. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- F. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- G. Install devices and wall plates flush and level.
- H. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.
- I. Floor Box Installation:
 - 1. Set boxes level and flush with finish flooring material.
 - 2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
 - 3. Provide a minimum horizontal offset of 24 inches between boxes.
 - 4. Provide saw-cutting and patching of existing concrete floors as necessary for floor box installations within existing floors.

END OF SECTION

SECTION 26 28 16
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches
- B. Non-fusible switches
- C. Molded case switches
- D. Enclosures

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.3 REFERENCES

- A. NEMA KS 1 - Enclosed Switches

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
- C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
 - 1. Square D 3110 Series
 - 2. Eaton DH Series
 - 3. ABB TH Series
 - 4. Siemens HNF / HF Series
- B. **[FDS-#]:** Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.
- C. **[DS-#]:** Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- D. Enclosures: Type as indicated on the disconnect schedule.
- E. Accessories: As indicated on the disconnect schedule.

2.2 MOLDED CASE CIRCUIT BREAKERS AND SWITCHES

- A. Acceptable Manufacturers:
 - 1. Square D
 - 2. Eaton
 - 3. ABB
 - 4. Siemens
- B. **[CB-#]:** Molded Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip settings.
 - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t responses.
 - 4. Current Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
- C. Accessories: As indicated on the disconnect schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on the drawings.
- B. Install fuses in fusible disconnect switches.
- C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

3.2 ADJUSTING

- A. Set field-adjustable circuit breaker trip ranges.

END OF SECTION

SECTION 26 28 21

CONTACTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lighting contactors
- B. Enclosures

1.2 RELATED SECTIONS AND WORK

- A. Refer to Lighting Contactor Schedule.

1.3 REFERENCES

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies
- C. UL 508 - Industrial Control Equipment

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 26 05 00.
- B. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, and poles.
- C. Submit manufacturer's instructions under provisions of Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric
- B. Eaton Corporation
- C. G.E.
- D. ASCO

2.2 [LC-1]: LIGHTING CONTACTORS

- A. Contactors: NEMA ICS 2 and UL 508; electrically held, 3-wire control.
- B. Coil Operating Voltage: 120 volts, 60 Hertz.
- C. Contacts: As indicated on the drawings.
- D. Enclosure: ANSI/NEMA ICS 6; Type 1.
- E. Provide solderless pressure wire terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction boxes: and equipment enclosures.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

SECTION 26 32 13
PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Packaged engine generator system
- B. Exhaust silencer and fittings
- C. Remote annunciator panel
- D. Battery and charger
- E. Weatherproof enclosure

1.2 REFERENCES

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers
- C. ANSI/NEMA MG 1 - Motors and Generators
- D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines
- E. NFPA 70 - National Electrical Code (NEC)
- F. NFPA 110 - Standard for Emergency and Standby Power Systems
- G. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines
- H. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, and remote annunciator.
- D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.
- E. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

1.4 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Section 26 05 00.
- B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.
- C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.
- D. Provide one fuse for every type and rating used.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.

- C. Accept packaged engine generator set and accessories on site in crates and verify damage.
- D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.6 SYSTEM DESCRIPTION

- A. Engine generator system to provide source of emergency and standby power.
- B. System Capacity: 200 KW, 250 KVA at an elevation of 1,000 feet above sea level, and ambient temperature between -20°F and 110°F; standby rating using engine-mounted radiator.
- C. Emergency Power Supply System (EPSS) shall be NFPA 110 Type 10 Class 2 Level 2.
- D. Operation: In accordance with ANSI/NFPA 99.

1.7 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 26 05 00 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings. Show generator, fuel system components, battery system components, and exhaust system in 1/4" scale plan of room.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 26 05 00.
- B. Accurately record location of engine generator and mechanical and electrical connections.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.
- B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of the project site.

1.11 WARRANTY

- A. Provide a five (5) year warranty under provisions of Section 26 05 00.

1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Caterpillar.
- B. Cummins Power Generation.
- C. Kohler.
- D. GE Waukesha

2.2 [GEN-#]: PACKAGED ENGINE-GENERATOR SET

- A. Packaged engine-generator set shall be a coordinated assembly of compatible components.
- B. Safety Standard: Comply with ASME B15.1 and UL 2200.
- C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.
- D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.
- E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.

2.3 ENGINE

- A. EPA certified.
- B. Type: Water-cooled in-line or V-type, four-stroke cycle spark-ignition internal combustion engine.
- C. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.
- D. Fuel: Appropriate for use of natural gas.
- E. Engine Speed: 1800 RPM.
- F. Governor: Isochronous type with speed sensing.
- G. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- H. Frequency Response:
 - 1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - 2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.
- I. Fuel System: Natural gas system carburetor, secondary gas regulator, fuel shutoff solenoid valve, and flexible fuel connectors.
- J. Lubrication System: Engine or skid mounted filter and strainer, thermostatic control valve capable of full flow and designed to be fail safe, and crankcase drain arranged for gravity drainage with siphon or pump.
- K. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F, and suitable for operation on 120 208-3Ø volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.

- L. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.
 - 1. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Airflow Restriction: 0.5 inches of water, maximum.
 - 2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
 - 3. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.
- M. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel. Provide the following accessories:
 - 1. Battery: Voltage to match starter with capacity for three cranking cycles without recharge. Provide with battery cables and acid resistant battery tray.
 - 2. Battery-Charging Alternator: Factory mounted on engine with solid state voltage regulation.
 - 3. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
 - 4. **[BC-#]:** Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.
- N. Exhaust System: Industrial type silencer (20 to 75 Hz frequency range; 87 dBA max at 25 feet), side inlet with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. Silencer shall include a threaded opening for connection of ¾" drain line. Opening shall be flush on inside of silencer.
- O. The packaged engine generator shall comply with the current Environmental Protection Agency EPA Emissions standards.
- P. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.
- Q. Mounting: Provide unit with suitable spring-type vibration isolators.

2.4 GENERATOR

- A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.
- B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.
- C. Insulation: ANSI/NEMA MG 1, Class H.
- D. Temperature Rise: 105°C continuous.
- E. Enclosure: ANSI/NEMA MG 1; open drip-proof.
- F. Voltage Regulation:
 - 1. The maximum instantaneous voltage dip (IVD) shall be 28 percent for building loads.

2. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation ± 1 percent from no load to full load. Include manual controls to adjust voltage drop ± 5 percent voltage level, and voltage gain.
- G. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- H. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.5 CONTROLS AND INDICATION

- A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- B. Ground Fault: Provide ground fault sensing at the generator. The sensor shall be located ahead of the generator service disconnect. Provide a ground fault indication on the engine-generator control panel. Provide an instruction nameplate at the control panel.
 1. Instruction nameplate: Provide operational instructions for a ground fault indication as approved by the local Authority Having Jurisdiction.
- C. **[GCP-#]:** Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
 1. Alarm indication as required by NFPA 110 for a Level **1 2** system.
 2. AC frequency meter.
 3. AC output voltmeter with phase selector switch.
 4. AC output ammeter with phase selector switch.
 5. Output voltage adjustment.
 6. DC voltmeter (alternator battery charging).
 7. Engine start/stop selector switch.
 8. Engine running time meter.
 9. Oil pressure gauge.
 10. Engine coolant temperature gauge.
 11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
 12. Fuel derangement alarm.
 13. Generator overload.
 14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
 15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
 16. Ground fault indication.
 17. Generator control and start signal failure.
 18. 80% load alarm.
 19. **Bacnet capable.**
- D. **[GAP-#]:** Remote Engine Annunciator Panel: ANSI/NFPA 99 and NFPA 110 for a Level 2 system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in a surface mounted panel with finish selected by architect. Provide all interconnecting wiring in conduit per manufacturer's

requirements by the Electrical Contractor. The remotely reported alarms shall include the following.

1. Overcrank
2. Low water (engine) temperature
3. High engine temperature pre-alarm
4. High engine temperature
5. Low lube oil pressure pre-alarm
6. Low lube oil pressure
7. Overspeed
8. Low coolant level
9. Not in auto
10. Emergency Power Supply (EPS) supplying load
11. High battery voltage
12. Low battery voltage
13. Battery charger failure (includes AC failure)
14. Generator running
15. Normal utility power
16. Emergency stop
17. Emergency Power Off Switch activated (EPO)
18. Alarm for power supply or UPS serving motorized breakers
19. Generator control and start signal failure.
20. 80% load alarm.
21. **Bacnet capable**

E. Building Automation System Integration:

1. Provide a terminal block to allow the Facility Monitoring and Control System (FMCS) to report generator alarms. Provide individual terminal points for each of the annunciator alarms and pre-alarms. Provide an additional terminal point to combine all generator alarms under a single terminal point. Provide a permanent label for each terminal point. Each terminal will provide a binary output for the FMCS to read. Refer to Section 23 09 00 for alarms reported by the FMCS.

2.6 ACCESSORIES

- A. Generator Circuit Breaker: Molded or insulated case, service-rated thermal-magnetic electronic trip type; 100% rated breaker complying with NEMA AB1 and UL 489. The disconnect shall simultaneously open all associated ungrounded conductors and be lockable in the open position.
1. Tripping Characteristic: Designed specifically for generator protection.
 2. Trip Rating: Matched to generator rating.
 3. Shunt Trip: Connected to trip breaker when generator is shut down by other protective devices.
 4. Mounting: Provide freestanding enclosure or mount integrally with control and monitoring panel.
 5. The disconnecting means shall also shut down the prime mover, disable all start control circuits, and be configured with a mechanical reset.

- B. **[EPO]:** Remote Manual Stop Station (Emergency Power Off EPO): Provide a remote manual stop station with weather proof stainless steel or die cast housing, red mushroom button - push to stop operation, breakable cover/lens to access mushroom button, 120-volt rated. The manufacturer shall provide automatic monitoring of the EPO switch. Placing the EPO switch in the "Generator Powered OFF" status shall initiate a visual and audible alarm at each generator annunciator panel.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT

- A. Prefabricated or pre-engineered skintight enclosure with the following features:
1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
 2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.
 3. Structural Design and Anchorage: Wind resistant up to 100 mph.
 4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays.
 5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
 6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
 7. The exhaust system silencer shall be installed within the enclosure housing.
 8. Acoustical Treatment: Provide acoustical treatment of the generator enclosure including wall panels, intake and exhaust air paths, ventilation openings, and tailpipe exhaust. Maximum sound level horizontally from the generator set shall be 70 dBA at 33 feet in a hemispherical free field in the configuration shown on the drawings. Sound attenuators shall be concealed within the enclosure panels. Panels shall extend from the enclosure base frame to the height of the generator section.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on the drawings.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install remote manual stop station in location shown on plans. Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker and signal the engine prime mover to stop.

- C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.

3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 26 05 00 and in compliance with NFPA 110 requirements.
- B. Provide portable test bank for full load test, if required. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
- C. The on-site installation test shall be conducted as follows:
 - 1. With the prime mover in a "cold start" condition and the emergency load at standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.
 - 2. The test load shall be that load that is served by the Emergency Power Supply System (EPSS).
 - 3. The time delay on start shall be observed and recorded.
 - 4. The cranking time until the prime mover starts and runs shall be observed and recorded.
 - 5. The time taken to reach operating speed shall be observed and recorded.
 - 6. The voltage and frequency overshoot shall be recorded.
 - 7. The time delay on transfer to emergency power for each switch shall be recorded. Life safety and critical branch transfer switches must transfer within 10 seconds.
 - 8. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
 - 9. The voltage, frequency, and amperes shall be recorded.
 - 10. The prime mover oil pressure and water temperature shall be recorded, where applicable.
 - 11. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter.
 - 12. When primary power is returned to the building or facility, the time delay on retransfer to primary for each switch with a minimum setting of 5 minutes shall be recorded.
 - 13. The time delay on the prime mover cool down period and shutdown shall be recorded.
 - 14. Allow prime mover to cool for 5 minutes.
 - 15. A load shall be applied for 4 hours total. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate rating of the Emergency Power Supply (EPS), less applicable derating factors for site conditions. Observe and record load changes and the resultant effect on voltage and frequency.
 - 16. The full load test shall be initiated immediately after the cooling time has expired by any method that starts the prime mover and, immediately upon reaching rated rpm, picks up 100 percent of the nameplate kW rating on one step, less applicable derating factors for site conditions.

17. During test, record the following at 5-minute intervals for the first 15 minutes and every 15 minutes for the rest of the test:
 - a. Kilowatts
 - b. Amperes
 - c. Voltage
 - d. Frequency
 - e. Coolant temperature
 - f. Enclosure temperature (interior)
 - g. Oil pressure
 - h. Engine exhaust temperature
 - i. Engine inlet temperature
 - j. Oil Temperature
 - k. Battery charge rate
18. Upon completion of the test and after a cool down period, the crank/rest cycle shall be tested.
 - a. Any method recommended by the manufacturer for the cycle crank test shall be utilized to prevent the prime mover from running.
 - b. The control switch shall be set at "run" to cause the prime mover to crank.
 - c. The complete crank/rest cycle shall be observed and recorded.
19. Test alarm and shutdown circuits by simulating conditions.
- D. Testing documentation shall be submitted to the Architect/Engineer for review and approval.
- E. Generator testing worksheets are included with this specification section.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare, start, test, and adjust systems under provisions of Section 26 05 00.

3.5 ADJUSTING

- A. Adjust generator output voltage and engine speed.

3.6 CLEANING

- A. Clean work under provisions of Section 26 05 00.
- B. Clean engine and generator surfaces. Replace oil and fuel filters.

3.7 DEMONSTRATION

- A. Provide systems demonstration. Coordinate the demonstration schedule with the Owner and Architect/Engineer.
- B. Describe loads connected to emergency and standby systems and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide emergency and standby power.

END OF SECTION

DATE: _____
 CUSTOMER: _____
 ENGINE MODEL: _____
 GENERATOR MODEL: _____
 UNIT RATING: _____

W.O.# _____
 S/N: _____
 S/N: _____
 PKG _____

BATTERY VOLT: 24
 VOLTAGE: 208
 FUEL TYPE: Natural Gas
 TESTED BY: _____

kW: 200
 KVA: 250
 PHASE: 3
 HERTZ: 60
 RPM: 1800

ELAPSED TIME	DURATION	1	2	3	1	2	3		TARGET			HOUR METER	P.F.	OIL PRESS.	FUEL PRESS.	AMBIENT AIR TEMP.	ENGINE WATER TEMP.	EXHAUST TEMP		ENGINE OIL TEMP.	IN.HG BOOST	COOLANT AT HEAT EXCH. OR RADIATOR		COOLANT AT THE ENGINE		
		VOLTS	VOLTS	VOLTS	AMPS	AMPS	AMPS		KW									KW	L			R	OUT	IN	OUT	IN
0:10	0:10								50																	
0:20	0:10								100																	
0:40	0:20								200																	
1:00	0:20								200																	
1:20	0:20								200																	
1:40	0:20								200																	
2:00	0:20								200																	
2:20	0:20								200																	
2:40	0:20								200																	
3:00	0:20								200																	
3:20	0:20								200																	
3:40	0:20								200																	
4:00	0:20								200																	
4:10	0:10								220																	
4:20	0:10								100																	
4:25	0:05								-																	

Load Profile Time Load %
 10 Min 25%
 10 Min 50%
 4 Hours 100%
 10 Min 110%
 10 Min 50%
 5 Min 0%

SECTION 26 36 00
TRANSFER SWITCH

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Automatic transfer switch [ATS-#]

1.2 RELATED SECTIONS AND WORK

- A. Refer to the Transfer Switch Schedule for rating and configuration.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

1.4 REFERENCES

- A. NEMA ICS 1 - General Standards for Industrial Control and Systems
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies
- C. NEMA ICS 2-447 - AC Automatic Transfer Switches
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- E. UL 1008 - Standard for Automatic Transfer Switches

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00.
- B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.
- C. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 26 05 00.
- B. Include instructions for operating equipment.
- C. Include instructions for operating equipment under emergency conditions when engine generator is running.
- D. Identify operating limits which may result in hazardous or unsafe conditions.
- E. Document ratings of equipment and each major component.
- F. Include routine preventive maintenance and lubrication schedule.
- G. List special tools, maintenance materials, and replacement parts.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for emergency and standby electrical systems.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

- A. Acceptable Manufacturers:
 - 1. ASCO 300 Series
 - 2. Russelectric RMT Series
 - 3. ABB Zenith ZTG Series
 - 4. Caterpillar CTG Series
 - 5. Cummins OTPC Series

- 6. Generac W Series
- 7. Kohler KCS Series
- B. Description: NEMA ICS 2; service entrance rated automatic transfer switch.
- C. Configuration: Electrically-operated, mechanically-held transfer switch.
- D. Control panel shall be micro-processor based.
- 2.2 SERVICE CONDITIONS**
 - A. Service Conditions: NEMA ICS 1.
- 2.3 RATINGS**
 - A. Refer to the one-line diagrams for the available interrupting capacity (AIC) of the transfer switch. The transfer switch shall be series rated with the equipment feeding the transfer switch. The series rating shall be the larger of the two AIC values when the AIC rating of the equipment feeding the normal and emergency sides of the transfer switch is not equal.
 - B. Series rating with upstream devices shall be allowed per UL-1008.
- 2.4 AUTOMATIC SEQUENCE OF OPERATION**
 - A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
 - B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.
 - C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
 - D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.
 - E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
 - F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.
 - G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.
- 2.5 ENCLOSURE**
 - A. Enclosure: NEMA ICS 6; Type 1.
- 2.6 ACCESSORIES**
 - A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
 - B. Test Switch: Key operated or password protected switch. Mount in cover of enclosure to simulate failure of normal source.
 - C. Engine Start Signal: Rated 10 amps at 30VDC shall be provided to start the engine generator in the event of a normal source outage.
 - D. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
 - E. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed indicating switch to normal source or emergency source.
 - F. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value, values shall be field adjustable.
 - G. Alternate Source Monitor: Monitor each line of alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent Hertz from rated nominal voltage, values shall be field adjustable.

- H. Engine Exerciser: Start engine every 7 days. Run for 30 minutes before shutting down. Each event shall be configurable for Test with Load or Test Without Load. Bypass exerciser control if normal source fails during exercising period.
- I. In-Phase Monitor: Inhibit transfer until source and load are within 30 electrical degrees.
- J. Provide 2 N.O. and 2 N.C. isolated contacts to indicate:
 - 1. Normal source available.
 - 2. Emergency source available.
 - 3. Exercise mode in operation.
- K. Serial Communication Port: Two twisted pairs of shielded communication cable in conduit shall daisy chain all transfer switches with a remote annunciator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, electronic equipment, and receptacle devices.

1.2 QUALITY ASSURANCE

- A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.
- B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

1.3 REFERENCES

- A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components
- B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components
- C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits
- E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices
- F. CBEMA - Computer Business Equipment Manufacturers Association
- G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage
- H. National Electrical Code 285 - Surge Protection Devices
- I. NFPA 70 - National Electrical Code
- J. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors
- K. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)
- L. UL 248-1 - Fusing
- M. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

1.4 SUBMITTALS

- A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.
- B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

1.5 SPARE PARTS

- A. Surge Protection Modules: Furnish 1 replacement module for each type installed.
- B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

1.6 TESTING, WARRANTY AND LIFE EXPECTANCY

- A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.
 - 1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
 - 2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
 - 3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.
- B. Minimum Repetitive Surge Current Capacity:
 - 1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
 - 2. Minimum Repetitive Surge Current Capacity Test:
 - a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
 - b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
 - c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.
 - 3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
 - 4. Proof of such testing shall be the test log generated by the surge generator.
- C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.
- D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.2 RATINGS

A. [SPD-1]: Service Entrance Suppressors:

1. For 120/208-volt, 3 phase, 4 wire, type 2, category C3 unit.
 - a. Surge current capacity: 100,000/200,000 amps per protection mode/phase
 - b. Nominal Discharge Current: 20 kA.
 - c. Mounting: Refer to the drawings.
 - d. Voltage Protection Rating: Refer to requirements below.
 - e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
 - f. Disconnect: Surge-rated disconnect with 200,000 SCCR.
2. Approved Manufacturers:
 - a. Square D Surgellogic EMA Series
 - b. Siemens TPS3 Series
 - c. Eaton SPD Series
 - d. Current Technology Current Guard Plus
 - e. ASCO Power Technologies 400 Series
 - f. LEA International LSS Series

B. Voltage Protection Rating:

1. Protection modes and UL 1449 voltage protection rating for surge suppression units per each mode (L-N, L-L, L-G, and N-G as appropriate).
 - a. 120/208 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L

C. EMI/RFI Noise Rejection or Filtering:

1. Each unit shall include a UL1283 first order, high-frequency filter for noise filtering between 10 KHz and 100 MHz.

D. Indication:

1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
2. Provide each service entrance type unit(s) with a transient counter.
3. Each unit shall contain form "C" contacts for remote indication of an alarm status.

E. Fuses:

1. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit.
2. Fuses shall be rated 200, 000 AIC minimum interrupting capacity.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.
- B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.2 INSTALLATION

A. Mounting Location:

1. The unit shall be installed as close as practical to the panel in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
2. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

1. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard. Single phase 120-volt units shall be hardwired without a disconnecting means.
 - a.

C. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.

END OF SECTION

SECTION 26 51 19

LED LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires and accessories
- B. Exterior luminaires and accessories
- C. Light-emitting diode (LED) luminaire systems
- D. LED emergency lighting units
- E. Emergency exit signs
- F. Emergency inverter for LED light engines (individual luminaires - integral)

1.2 RELATED SECTIONS

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
 - 1. 26 09 33 Lighting Control Systems
 - 2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details

1.3 REFERENCES

- A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- D. IEEE C2 - National Electrical Safety Code
- E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
- F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
- I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
- J. UL 924 - Standard for Emergency Lighting and Power Equipment

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Basic Requirements of Submittal:
 - 1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.

2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
3. Include outline drawings, support points, weights, and accessory information for each luminaire.
4. Submit manufacturer origin of LED chipset and driver.
- C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):
 1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
 2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.
- D. LED Lighting - Control Compatibility Submittal:
 1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.
- E. Submit utility rebate forms where offered at project location. Submit completed rebate forms within 30 days of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect under provisions of Section 26 05 00.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.
- C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.6 WARRANTY

- A. The warranty period begins at the date of Substantial Completion.
- B. LED Light Engines and Drivers:
 1. LED Drivers and Dimming Drivers: Five (5) years
 2. Light Emitting Diode (LED) Light Engines: Five (5) years
- C. Emergency Lighting Units and Exit Signs:
 1. Emergency Lighting Units: Three (3) year, non-prorated
 2. Exit Signs: Three (3) year, non-prorated
 3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.
- D. Emergency Drivers:
 1. Emergency LED Driver: Five (5) years

1.7 REGULATORY REQUIREMENTS

1. Conform to NFPA 101 for installation requirements

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall

assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.

- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction. Provide ballast covers to separate inboard/outboard lamps when multi-level switching is indicated, so light does not spill into unlit cells.
- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
- E. Painted reflector surfaces shall have a minimum reflectance of 90%.
- F. All painted components shall be painted after fabrication.

2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.
- B. Provide low temperature ballasts or LED drivers, with reliable starting to -20°F.
- C. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.3 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

- A. Light emitting diodes used in interior applications shall have a minimum color rendering index (CRI) of 80. Light emitting diodes used in exterior applications shall have a minimum color rendering index (CRI) of 70. Color temperature of the luminaires shall be as noted on the luminaire schedule. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step MacAdam ellipse unless noted otherwise.
- B. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.
- C. Rated life shall be minimum of 50,000 hours at L70.
- D. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.
- E. Luminaire minimum lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.
- F. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.
- G. LED light engine shall have a maximum LLD of 0.85 at 50,000 hours at 25°C ambient.
- H. LED Driver:
 - 1. Solid state driver with integral heat sink. Driver shall have over-heat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 10 %. Driver shall have a voltage fluctuation tolerance of +/- 10%.
 - 2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type. Dimming shall control light output in a continuous curve from 100% to 10% unless noted otherwise.
 - 3. Driver shall have a minimum of 50,000 hours rated life.
 - 4. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor. Driver start time shall be less than 0.5 seconds to 98% of initial light output. Flicker should be less than 30% throughout the operating range.
 - 5. Driver shall be field replaceable without removal of the luminaire.
 - 6. Class A sound rating; inaudible in a 27 dBA ambient.

7. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

2.4 EMERGENCY EXIT SIGNS

- A. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, test switch, AC ON pilot light, automatic charger, and electronic circuitry. Power failure relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.
- C. Self-Diagnostics and Testing:
 1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
 2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

2.5 EMERGENCY INVERTER FOR LED LIGHT ENGINES (INDIVIDUAL LUMINAIRES - INTEGRAL)

- A. Unit: Self-contained, with automatic transfer to battery supply on loss of normal power, UL 924 listed for factory or field installation, indoor and damp locations, 32°F to 122°F (0°C to 50°C) operating temperature. Compatible with switched, dimmed, and unswitched lighting controls. Compatible with LED light engines. The inverter output shall be sinusoidal with solid-state low voltage disconnect circuit.
- B. Battery: Sealed, high temperature, maintenance free, nickel cadmium battery with capacity to provide 90 minutes of emergency operation at full lumen and wattage output, with 24-hour recharge time. Refer to Luminaire Schedule for lumen and wattage requirements.
- C. Features: Integral battery charger with LED charging indicator light, test switch, electronic circuitry for use with ballasts and LED drivers. Test and monitor switch shall be integral to luminaire
- D. Factory and Field Installation: Listed for installation inside and adjacent to luminaire. Refer to Luminaire Schedule for individual luminaire requirements. Remote-mounted units shall be located above finished ceiling, adjacent to luminaire, and accessible from below through luminaire opening.
- E. Self-Test Diagnostics and Testing: Provide with listed automatic monthly self-test diagnostics.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. Provide a minimum of two (2) #12 gauge wires located on diagonal corners of luminaires. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications
- B. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Support luminaires independent of ceiling with a minimum of two (2) #12 gauge wires located on diagonal corners.

- C. Support surface-mounted luminaires directly from building structure. Install luminaires larger than eight square feet (8 ft²) or weighing more than 30 pounds independent of ceiling framing. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- D. Support suspended or pendant mounted luminaires independent of ceiling grid with a minimum of two #12 gauge wires located on diagonal corners. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
- E. Install lamps in lamp holders of luminaires.
- F. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.
- G. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.
- H. Industrial Pendant Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between ballast and structure. Provide safety chain between reflector and ballast.

3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES

- A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.3 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

- A. Install units plumb and level.
- B. Aim directional lamp heads as directed.
- C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.4 RELAMPING

- A. Replace failed LED light engine modules or arrays at completion of work.

3.5 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

3.6 OWNER TRAINING

- A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.
- B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.7 LUMINAIRE SCHEDULE

- A. As shown on the drawings, sheet E500.

END OF SECTION

SECTION 27 05 00

BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the Communications Systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the Communications Systems a finished and working system.
- C. Description of Systems include but are not limited to the following:
 - 1. Complete Structured Cabling System including, but not limited to:
 - a. Voice and data horizontal cabling and terminations.
 - b. Information outlets (IOs) including faceplates, jacks and labeling.
 - c. Equipment racks, cabinets, cable management and equipment.
 - d. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.
 - e. Cabling pathways.
 - f. Grounding and Bonding
 - g. Testing
 - 2. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
 - 3. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
 - 4. Firestopping of penetrations as described in Division 7.

1.3 WORK SEQUENCE

- A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.
- B. Itemize all work and list associated hours and pay scale for each item.

1.4 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to the nearest cable tray. Where surface mounted backboxes are required, conduit shall be routed to the nearest cable tray.

C. General:

1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, cable tray, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Cable Trays, including 12" access space

- f. Sprinkler Piping and other Piping
 - g. Conduit and Wireway
 - h. Open Cabling
- D. Electrical Contractor's Responsibility:
 - 1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
 - 2. Assumes all responsibility for providing and installing cable tray.
 - 3. Responsible for Communications Systems grounding and bonding.
 - 4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- E. Technology Contractor's Responsibility:
 - 1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
 - 2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
 - 3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
 - 4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
 - 5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

- A. Definitions:
 - 1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
 2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
 3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
 2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
 3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
 4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.
- D. General:
1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion but will not perform as a coordinator.
 2. A plotted set of coordination drawings shall be available at the project site.
 3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

- A. Telecommunications Structured Cabling System Standards:
 1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
 - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
 - b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
 - 1) C.1 - Commercial Building Telecommunications Standard
 - 2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard

- 3) C.3 - Optical Fiber Cabling Components Standard
 - 4) C.4 - Broadband Coaxial Cabling and Components Standard
- c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces
- d. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- e. ANSI/TIA-862-A - Building Automation Systems Cabling Standard
- f. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- g. NFPA 70 (NEC) - National Electrical Code (Current Edition)
- h. UL 444 - Standard for Safety for Communications Cable
- B. Refer to individual sections for additional Quality Assurance requirements.
- C. Qualifications:
 - 1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
 - 2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
 - 3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
 - 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.
 - 5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
 - 6. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
- D. Compliance with Codes, Laws, Ordinances:
 - 1. Conform to all requirements of the City of Colfax, IA Codes, Laws, Ordinances and other regulations having jurisdiction.
 - 2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
 - 3. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
 - 4. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with

the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.

5. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
6. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.

F. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.

6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.
- G. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
 5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
 6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
 7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
 8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.
- H. Field Measurements:
1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
 2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.
 3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

**Referenced
Specification**

Section

Submittal Item

27 05 26

Communications Bonding

27 05 28

Interior Communications Pathways

27 05 53

Identification and Administration

**Referenced
Specification**

Section

Submittal Item

27 11 00	Communication Equipment Rooms
27 15 00	Horizontal Cabling Requirements
27 17 10	Testing

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:
1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Description of items submitted and relevant specification number
 - e. Notations of deviations from the contract documents
 - f. Other pertinent data
 2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Description of item submitted (using project nomenclature) and relevant specification number
 - g. Notations of deviations from the contract documents
 - h. Other pertinent data
 - i. Provide space for Contractor's review stamps
 3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
 4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
 - e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 27 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 27 XX XX.description.YYYYMMDD
 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
1. Indicated by Architect/Engineer.
 2. Change of Subcontractor or supplier occurs.
 3. Change of product or equipment occurs.

1.9 CHANGE ORDERS

- A. A detailed material and labor take-off shall be prepared for each change order along with labor rates and mark-up percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.10 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, and that the equipment is ready for operation:
 - 1. Firestopping, including mechanical firestop systems.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.13 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.14 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.15 CONTINGENCY

- A. Include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.16 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 Cable Jacket Rating: This project requires all cable jackets to carry a plenum rating.

2.2 Refer to individual sections.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

- A. General:
 - 1. Refer to specific Division 27 sections for further requirements.
 - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
 - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
 - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
 - 5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.
- B. Protection of cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
 - 2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
 - 2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
 - 3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
 - 1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
 - 2. Submitted bound copies of approved shop drawings.
 - 3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
 - 4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
 - 5. Submitted testing reports for all systems requiring final testing as described herein.
 - 6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
 - 7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.
 - 8. Provide System Assurance Warranty certificate for the telecommunications system.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
 - 1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
 - 2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
 - 1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be

rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div27.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- E. Refer to the individual specification sections for minimum hours of instruction time for each system.
- F. Operating Instructions:
 - 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
 - 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM COMMISSIONING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any

changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

3.10 CONSTRUCTION WASTE MANAGEMENT

- A. This Contractor shall comply with all construction and demolition waste disposal and recycling requirements outlined in LEED MRc2: Construction Waste Management (follow latest edition at the time of bidding or as referenced in these specifications).
 - 1. This Contractor shall coordinate with the General Contractor to develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled.
 - 2. The Contractor shall track waste disposal and recycling efforts throughout the construction process for all materials associated with this Contractor's scope of work. The Contractor shall provide this information to the General Contractor so that it can be incorporated with similar information from all other contractors for the project.
 - a. Calculations for waste and recycled material can be done by weight or volume, but they must be consistent throughout the project. The Contractor shall coordinate with the General Contractor to establish the preferred calculation method and report the results accordingly.
 - b. Excavated soil and land-clearing debris do not count towards the waste disposal or recycled material.
 - 3. At a minimum, 50% of the construction and demolition debris for this project must be recycled or salvaged.

END OF SECTION

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 75% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 25% of testing has been completed.
6. Telecommunications labeling has been provided on at least 25% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
9. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

The project will be ready for final jobsite observation prior to the requested date of the observation according to the above list of requirements.

Prime Contractor: _____

By: _____

Requested Observation Date _____

Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

Telecommunications – Proof of Certification

There are specific Contractor qualification requirements for this project as defined in Section 27 05 00. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer _____. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20_____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____ Manufacturer Certification Number (if any): _____

Submit the following with the bid:

- This form.
- Proof of Manufacturer Certification indicated above.

SECTION 27 05 26
COMMUNICATIONS BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (TMGB)
- D. Rack-mount Telecommunications Grounding Busbar

1.2 RELATED WORK

- A. Section 26 05 33 – Conduit and Boxes
- B. Section 26 05 36 – Cable Trays
- C. Section 26 05 13 – Wire and Cable
- D. Section 26 05 26 – Grounding and Bonding
- E. Section 26 41 00 – Lightning Protection Systems
- F. Section 27 05 00 – Basic Communications Systems Requirements
- G. Section 27 11 00 – Communication Equipment Rooms
- H. Section 27 05 28 – Interior Communication Pathways
- I. Section 27 05 53 – Identification and Administration

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.
- B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.
- C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.4 REFERENCES

- A. ANSI/IEEE 1100 – Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA/EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA/EIA 606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA/EIA 758 – Customer Owned Outside Plant
- F. ANSI-J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- G. IEEE 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 – National Electrical Code
- J. NFPA 780 – Standard for the Installation of Lightning Protection Systems

- K. UL 96 – Lightning Protection Components
- L. UL 96A – Installation Requirements for Lightning Protection Systems
- M. UL 467 – Grounding and Bonding Equipment

1.5 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Section 27 05 00 and Division 1.
- B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
 - 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Provide CAD-generated, project-specific system shop drawings as follows:
 - 1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where system equipment will be located.
 - 2. Installation details for all system components.
- D. Provide system checkout test procedure to be performed at acceptance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 27 05 00.
- B. Store and protect products under the provisions of Section 27 05 00.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.7 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.
- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.

- D. Basic System Requirements:
 - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-A and NFPA 70 for complete information.
 - 2. The bonding system shall include, but not be limited to, the following major components:
 - a. Bonding Conductor for Telecommunications (BCT)
 - b. Telecommunications Main Grounding Busbar (TMGB)
 - c. Rack mount Telecommunications Grounding Busbar(s)
 - d. Bonding Conductor(s) (BC)
 - e. Bonding Connectors
 - f. Bonding system labeling and administration as defined in Section 27 05 53.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 27 05 00.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
 - 1. Actual locations of system components, devices, and equipment.
 - 2. Actual conductor routing.
 - 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 27 05 00.
- B. Submitted data shall include:
 - 1. Approved shop drawings.
 - 2. Descriptions of recommended system maintenance procedures, including:
 - a. Inspection
 - b. Periodic preventive maintenance
 - c. Fault diagnosis
 - d. Repair or replacement of defective components

PART 2 - PRODUCTS

2.1 BONDING CONDUCTORS

- A. Bare Copper:
 - 1. Annealed uncoated stranded conductor.
 - 2. Minimum size 6 AWG.

- B. Insulated Copper:
 - 1. Annealed uncoated stranded conductor.
 - 2. Insulation:
 - a. PVC insulation with nylon outer jacket.
 - b. Rated ≥ 600 volts.
 - c. Green.
 - 3. Minimum size 6 AWG.
- C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.
- D. Bonding Conductor Sizing
 - 1. All Communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
Greater than 66 (20)	3/0

- 2. The BCT shall be the same size as the TBB or larger.

2.2 BONDING CONNECTORS

- A. Acceptable Types:
 - 1. Two-hole compression lug
 - 2. Exothermic weld
 - 3. Irreversible compression
- B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.
- C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3 GROUNDING BUSBAR (TMGB)

- A. Features:
 - 1. Wall-mount configuration.
 - 2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
 - 3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-A standards.
 - 4. Predrilled holes.

5. Integral insulators.
6. Stainless steel offset mounting brackets.
- B. Specifications:
 1. Material: Electrolytic tough pitch copper bar with tin plating.
 2. Minimum Dimensions: 1/4" thick x 4" high x 12" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
 3. Hole pattern shall include:
 - a. A minimum of 15 sets of 5/16" holes, 5/8" on center, to accommodate "A" spaced 2-hole compression lugs.
 - b. A minimum of three (3) sets of 7/16" holes, 1" on center, to accommodate "C" spaced 2-hole compression lugs.

2.4 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR

- A. Features:
 1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
 2. Predrilled holes.
 3. Mounts in a standard 19" equipment rack.
- B. Specifications:
 1. Material: Electrolytic tough pitch copper bar with tin plating.
 2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.
 - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
 3. Hole pattern shall include:
 - a. A minimum of eight (8) 6-32 tapped lug mounting holes on 1" centers.
 - b. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Bonding Requirements:
 1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
 2. A licensed electrician shall perform all bonding.
 3. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Telecommunications Main Ground Bar (TMGB) Requirements:
 1. Install TMGB such that it is insulated from its support with a minimum 2" standoff.

2. Bond the TMGB to the electrical service ground via the BCT.
 - a. A minimum of 1-foot (300 mm) separation shall be maintained between the BCT and any DC power cables, switchboard cable, or high frequency cables.
 3. TMGB shall be bonded to all electrical panels located in the same room or space as the TMGB or in an immediately adjacent space within 20 linear feet of the TMGB. TMGB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the TMGB.
 4. TMGB shall be bonded to accessible metallic building structure located within the same room or space as the TMGB.
 5. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the TMGB, shall be bonded to the TMGB.
 6. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the TMGB, shall be bonded to the TMGB.
- C. Rack-mount Telecommunications Ground Bar Requirements (RTGB):
1. Provide a rack-mount telecommunications ground bar in each equipment rack and equipment rack enclosure.
 2. Install RTGB such that it is electrically bonded to the rack. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between RTGB and equipment rack.
 3. Bond each RTGB to the TMGB via a BC.
 4. If more than one (1) RTGB is provided within the same room or space, they shall all be bonded together via a BC.
 5. All contractor-furnished and/or contractor-installed metallic communications equipment, including, but not limited to patch panels, active electronics, uninterruptible power supplies, etc., mounted within the same equipment rack as the RTGB, shall be bonded to the RTGB. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between equipment rack and installed metallic communications equipment. Active electronics and uninterruptible power supplies shall be bonded to the RTGB via a dedicated BC for each device.
- D. Metallic Interior Communication Pathway Bonding Requirements:
1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.
- E. Bonding Conductor Requirements:
1. Bonding conductors shall be green or marked with a distinctive green color.
 2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
 3. Bonding conductors shall not be installed in metallic conduit.

4. All conductors, including, but not limited, to the BCT and BC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.
 - a. Where documented permission to splice a conductor is granted:
 - 1) The number of splices shall be limited to as few as possible.
 - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
 - 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
 - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 05 53. In addition to the requirements of Section 27 05 53:
 - a. Labels shall be nonmetallic.
 - b. Labels shall be printer-generated.
 - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
 - d. Additionally, conductors shall be labeled as follows:
 - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.

F. Bonding Connection Requirements:

1. Make all connections in accessible locations to facilitate future inspection and maintenance.
2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
3. Thoroughly clean conductors before installing lugs and connectors.
4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.

7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

3.2 FIELD QUALITY CONTROL

- A. Field testing shall be performed under provisions of Section 27 05 00.
- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 27 05 00.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.4 TESTING

- A. Test installed system under provisions of Section 27 17 10.
- B. Measure and document resistance to ground at TMGB, each RTGB, and each electrical distribution panel bonded to the TMGB.
 1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
 2. Measured resistance to ground at TMGB and each RTGB must not exceed 5 ohms.
 3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- C. Include measurement documentation in test data submitted at completion of project under provisions of Section 27 17 10.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
 1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
 2. The Architect/Engineer shall be presented with the option to attend the training.
 3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.

- B. At a minimum, the following training shall be conducted:
 - 1. A course detailing the system functions and operations that a technical user will encounter. Provide training on all aspects of using the system, including making new bonding connections to the TMGB or RTGB. Provide training on all recommended inspection, maintenance, and repair procedures for the system.
- C. Minimum on-site training times shall be:
 - 1. Technical user: Two hours.

END OF SECTION

SECTION 27 05 28
INTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire mesh support systems, conduits, sleeves, innerduct, etc. for an interior cabling plant as shown on the drawings.
- B. Wire mesh support systems are defined to include but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 27 05 00 - Basic Communications Systems Requirements
- C. Section 27 05 26 - Communications Bonding

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for requirements.

1.4 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. NEMA VE 2-2000 - Cable Tray Installation Guidelines

1.5 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
 - 1. Include cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.6 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Refer to Section 26 05 33 for conduit requirements for this project.

2.2 WIRE MESH CABLE TRAY – OVERHEAD

- A. Acceptable Manufacturers:
 - 1. Cooper B-Line "Flextray"
 - 2. Cablofil, Inc.
 - 3. Wiremold "Fieldmate"

- B. General: Provide wire mesh of types and sizes indicated on drawings; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Provide drop-out fittings where cable tray is installed over equipment racks. Two drop-out fittings shall be installed over each rack so that a controlled radius is maintained into each side of every equipment rack that cable tray passes over. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- C. Wire mesh shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along wire mesh sides (flanges) shall be rounded during manufacturing for safety of cables and installers.
- D. Materials and Finishes: Material and finish specifications for each wire mesh type are as follows:
 - 1. Electro-Galvanized Zinc: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated zinc in accordance with ASTM B633 SC2. Additionally, straight sections shall be painted Computer White.
 - 2. Accessories:
 - a. Pre-Galvanized Zinc: Wall brackets and other pre-galvanized accessories shall be coated with zinc in accordance with ASTM A653.
 - b. Electro-Galvanized Zinc: Support accessories and miscellaneous hardware shall be coated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.
- E. Type of Overhead Wire Mesh Support System:
 - 1. All straight section longitudinal wires shall be straight (with no bends).
 - 2. Wire mesh supports shall be trapeze hangers or wall brackets. Center hung supports will not be allowed.
 - 3. Trapeze hangers are to be supported by 1/4 inch or 3/8-inch diameter rods.
 - 4. Provide manufacturer approved grounding clips as necessary for continuous grounding of tray.

2.3 CABLE HANGERS AND SUPPORTS

- A. Provide a non-continuous cable support system suitable for use with open cable.
- B. Cable Hooks:
 - 1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
 - 2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
 - 3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use.
- C. Cable Hangers:
 - 1. Adjustable, non-continuous cable support slings for use with low voltage cabling.
 - 2. Steel and woven laminate construction, rated for indoor non-corrosive use. Laminate material shall be suitable for use in plenum environments.
 - 3. Sling length shall be adjustable to a capacity of 425 4-pair UTP cables.
 - 4. Cabling hanger load limit shall be 100 lbs per foot.

5. Manufacturer: Erico Caddy, CableCat CAT425, Arlington Fittings TI Series or approved equal.

PART 3 - EXECUTION

3.1 CABLE HOOK SUPPORT SYSTEM

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.2 CONDUIT AND CABLE ROUTING

- A. Refer to Section 26 05 33 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.
- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
 1. A separate pull box is required for each 90' (or greater) length section.
 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.
- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.3 WIRE MESH TRAY INSTALLATION

- A. Install wire mesh as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- B. Cable tray sections shall be grounded in accordance with manufacturer's recommendations using manufacturer approved hardware. Painted sections shall have paint removed at each grounding attachment point.

- C. Test wire mesh support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to NFPA 70B, Chapter 18, for testing and test methods.
- D. Provide sufficient space encompassing wire mesh to permit access for installing and maintaining cables.
- E. Tray shall be continuous from source to termination and shall not change elevation, direction or otherwise expose cables to travel without 2" x 4" mesh support.
- F. Overhead tray shall be field cut using only manufacturer approved cutting device and methods. Cutting device shall be an offset blade bolt cutter; standard bolt cutters are specifically not permitted
- G. Bends in overhead tray shall be accomplished by utilizing manufacturer's cutting guides.
- H. All splices of tray shall be provided with splice washers, bars or springs as recommended by the manufacturer.

3.4 ATTACHMENT TO METAL DECKING

- A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION

SECTION 27 05 53
IDENTIFICATION AND ADMINISTRATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Documentation of labeling scheme.

PART 2 - PRODUCTS

2.1 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface and attachment method.
- D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.
 - 1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum "quiet zone" of 0.25" on each side of the bar code.
 - 2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.
- E. Tag all CAT 6 cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
 - 1. (Room Number) - (Outlet Number) - (Jack Number) - (Use).
 - 2. "Outlet Number" shall start with 1 in each room, with additional outlets in each room numbered sequentially.
 - 3. "Jack Number" shall start with 1 for the upper left jack in each outlet, increasing sequentially from left to right and top to bottom across the outlet face.
 - 4. "Use" shall be designated by the following:
 - a. "V" for voice (RJ-45)
 - b. "D" for data (RJ-45)
 - c. "C" for video (coax)
 - 5. Example #1: "106-1-1-V" indicates the top left voice jack in outlet #1 in Room 106.
 - 6. Example #2: "109-3-4-D" indicates the bottom right data jack (assuming a 4-port faceplate) in outlet #3 in Room 109.

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling: Horizontal cables shall be labeled at each end.

1. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
2. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

C. Termination Hardware Labeling:

1. An identifier shall be provided at each termination hardware location or its label.

D. Grounding/Bonding Labeling:

1. The TMGB shall be labeled "TMGB." There shall be only one TMGB in the facility.

END OF SECTION

SECTION 27 11 00
COMMUNICATION EQUIPMENT ROOMS (CER)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements
- B. Section 27 05 26 - Communications Bonding
- C. Section 27 05 28 - Interior Communication Pathways
- D. Section 27 15 00 - Horizontal Cabling Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for applicable standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
 - 1. Include ladder racking, equipment racks, cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT GROUNDING

- A. Refer to specification section 27 05 26 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.2 EQUIPMENT RACKS AND CABINETS

- A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.
- B. The equipment rack shall conform to the following requirements:
 - 1. Standard TIA/EIA 19" Floor Rack:
 - a. Equipment rack shall be 84" in height, self-supporting and provide a useable mounting height of 45 rack units (RU) (1 RU = 1 $\frac{3}{4}$ ").
 - b. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
 - c. Equipment rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per TIA/EIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

- d. Equipment racks shall be provided with a supply of spare screws (minimum of 24).
- e. Equipment racks shall be provided with a ground bar and #6 AWG ground lug.
- f. Provide all mounting hardware and accessories as required for a complete installation.

2.3 CABLE MANAGEMENT – VERTICAL AND HORIZONTAL

A. Equipment Racks:

- 1. Equipment racks shall be equipped with vertical and horizontal cable management hardware in the form of rings and guides. Racks shall incorporate vertical and horizontal covers, to allow an orderly, hidden, routing of copper from the modular patch panels to the customer provided network electronics. Vertical and horizontal cable management hardware shall be as follows:
 - a. Horizontal cable management hardware shall be 16 gauge cold rolled steel construction with six (6) pass-thru holes and seven (7) front-mounted 3.5" steel rod D-rings. Provide with cover designed to conceal and protect cable.
 - b. At a minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of jacks on modular patch panels.
 - c. Vertical cable management hardware shall provide for cable routing on front and rear of each rack and be 14" deep x 6" wide (minimum). Where multiple equipment racks are to be installed, this hardware shall be mounted between the uprights of adjacent equipment racks. Equipment rack uprights and the spacers shall be secured together per manufacturer's recommendations. Provide with cover designed to conceal and protect cable.
- 2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
- 3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.

2.4 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 15 00.
- C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be

designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.

- E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.5 LADDER RACK

- A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer's recommendations.
- B. Steel C-Channel Stringer Style Ladder Rack:
 - 1. Rolled steel siderail stringer, 2" stringer height, 9" spaced welded rungs.
 - 2. Steel shall meet the requirements of ASTM A1011 SS Grade 33.
 - 3. Loading limits shall be 292 lbs/ft for 4 ft spans.
- C. Ladder rack finish shall be flat black powder coat.

2.6 D-RINGS

- A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
- B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
- C. Provide 1/4" screw holes for wall mounting.

2.7 POWER STRIPS

- A. Provide power strips on all equipment racks, unless noted otherwise. These power strips shall have the following characteristics:
 - 1. Standard Rack Mount:
 - a. TIA/EIA 19" equipment rack mountable.
 - b. Compliant with UL-1449 Third Edition and UL-497A.
 - c. Provide transient suppression to 12,000-A. Protection shall be in all three modes (line-neutral, line-ground and neutral-ground).
 - d. Shall meet or exceed ANSI C62 Category A3 requirements.
 - e. Provide high-frequency noise suppression as follows:
 - 1) >20-dB @ 50 kHz
 - 2) >40-dB @ 150 kHz
 - 3) >80-dB @ 1 MHz
 - 4) >30-dB @ 6 to 1000 MHz
 - f. Protection Modes and UL 1449 Clamping Voltage: 475 volt L-N, L-G, and N-G.
 - g. Components: Nonmodular units composed of 20mm metal oxide varistors (MOV). Series inductors, SAD, or selenium cells may be used in addition to MOVs.
 - h. Be equipped with a 10-foot power cord.

2.8 COPPER PATCH CORDS

- A. Modular Patch Panel:
 - 1. Provide Category 6 Enhanced copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network

electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.

2. Refer to Section 27 15 00 for cable and connector performance requirements.
3. Patch cords shall not be made-up in the field.
4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):
 - a. Hubbell HC Series

2.9 DEMARCATION REQUIREMENTS

- A. Contractor shall coordinate all requirements for the demarcation point with the owner's selected service provider.
- B. The Contractor shall not proceed with any installation without written communication with the Architect/Engineer should the service provider's requirements differ from the work shown on the contract documents.
- C. Refer to the drawings for further requirements.

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS

- A. Equipment racks shall be furnished and installed as shown on the drawings.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.
- C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.
- D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.
- E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.
- F. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

3.2 LADDER RACK

- A. Provide support for ladder rack on 4 ft centers.
- B. Maintain a 1.5 safety factor on all load limits specified herein.
- C. Ladder rack support shall be by 5/8" diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

3.3 D-RINGS

- A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.
- B. Locate D-rings on 24" centers vertically and horizontally.
- C. Securely attach D-rings to the wall as required by the manufacturer.

3.4 GROUNDING

- A. Provide a complete grounding system in accordance with the requirements of Section 27 05 26.

3.5 CROSS CONNECT INSTALLATION

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.
- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

3.6 CONDUITS AND CABLE ROUTING

- A. Refer to Section 26 05 33 for additional requirements.
- B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents.
- C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.
- D. All conduits shall be reamed and shall be installed with a nylon bushing.
- E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.

END OF SECTION

SECTION 27 15 00
HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:
 - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
 - 2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

- A. CAT 6 Enhanced Cable:
 - 1. The horizontal cable requirements must be met as well as the following channel requirements.
 - 2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
 - 3. Performance Tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.
 - 4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
 - 5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed in Section 27 17 20 as an acceptable manufacturer. Specifically, products made by others through an OEM relationship are acceptable

if the products are marketed, branded, supported, warranted, and distributed by the same company.

6. The 4-connector channel performance margins in the table below shall be guaranteed margins above ANSI/TIA/EIA-568-C.2:

Electrical Value (1 - 250 MHz)	Minimum Margin
Insertion Loss:	14.0%
NEXT:	7.0 dB
PS NEXT:	8.0 dB
ACR-F (ELFEXT):	8.0 dB
PS ACR-F (PS ELFEXT):	8.0 dB
Return Loss:	4.0 dB

7. The jacket color for CAT 6 cable shall be white for voice applications and blue for data applications.
8. Basis of Design:
- Hubbell C6ES
 - Refer to Section 27 17 20 for additional acceptable manufacturers.

2.2 CONNECTORS/COUPLERS/ADAPTERS

- Refer to Section 27 11 00 for requirements.
- Coax (F-Connector):
 - RG-6 coax cable shall be terminated at the work area and at communication equipment rooms in a male F-type connector.
 - The male F-type connector shall:
 - Be matched to the RG-6 coax cable type proposed by the Contractor.
 - Be a single-piece F-type connector.
 - Incorporate a 1/2" crimp ring which uses hex crimp.
 - The male F-type connectors shall be mated to female/female feed-thru couplings at both the information outlet and modular patch panel locations. These couplings shall be matched to the male F-type connector. Couplings shall be of sufficient length as to allow for the male F-type connector to fully seat (both sides).

2.3 FACEPLATES/JACKS

- CAT 6 Jacks:
 - CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
 - The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
 - Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
 - Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack to be installed to supplement each such modular jack as defined by

this project. The installation of these supplemental modular jacks is NOT part of this project.

5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
6. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
 - a. Match the faceplate color used for other utilities in the building, or
 - b. When installed in surface raceway (if applicable), match the color of that raceway.
7. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
8. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.
9. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
10. CAT 6 modular jacks shall be pinned per TIA-568B.
11. CAT 6 termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:
 - a. ANSI/TIA/EIA-568-A-5
 - b. ANSI/TIA/EIA-568A
 - c. ISO/IEC 11801
 - d. IEC 603-7
 - e. FCC PART 68 SUBPART F
12. The color for CAT 6 jacks shall be white for voice applications and blue for data applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6 modular jack.

2.4 RG-6 BROADBAND RF COAXIAL CABLE

- A. Basic Construction:
 1. Center conductor: 18 AWG bare copper covered steel; 0.040" OD (nominal); foamed polyethylene dielectric.
 2. Four Layer Shield:
 - a. Inner shield: aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric.
 - b. Second shield: 60% 34 AWG bare aluminum braid wire.
 - c. Third shield: non-bonded aluminum foil tape.
 - d. Outer shield: 40% 34 AWG bare aluminum braid wire.
- B. Electrical Performance Characteristics:
 1. Impedance: 75 ohms.
 2. Velocity of propagation: $\geq 82\%$.
 3. Maximum attenuation (per 100 feet) for non-plenum rated cable:
 - a. at 55-MHz: 1.60 dB
 - b. at 450-MHz: 4.26 dB

- c. at 750-MHz: 5.59 dB
 - d. at 1000-MHz: 6.54 dB
 - 4. Maximum attenuation (per 100 feet) for plenum-rated cable:
 - a. at 50-MHz: 1.60 dB
 - b. at 400-MHz: 4.60 dB
 - c. at 700-MHz: 6.60 dB
 - d. at 1000-MHz: 8.20 dB
- C. Acceptable Manufacturers:
 - 1. Belden 1189A series
 - 2. CommScope
 - 3. West Penn
 - 4. Times Fiber

2.5 COPPER WORK AREA CORDS

- A. RJ-45:
 - 1. Provide the same quantity of Category 6 copper work area cords as copper patch panel cords specified in Section 27 11 00. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
 - 2. Work area cords shall be 10' in length.
 - 3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.
- B. RG-6 Broadband RF Coaxial with F-Connectors:
 - 1. Provide one (1) coaxial work area cable for each CATV information outlet location installed.
 - 2. Coaxial work area cables shall consist of quad-shielded RG-6 broadband RF coaxial cable meeting electrical performance characteristics specified earlier in this section and be equipped with compression-style F-connectors on each end.
 - 3. Work area cords shall be 7' in length.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

- A. Horizontal Cabling:
 - 1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
 - 2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
 - 3. Manufacturer's minimum bend radius specifications shall be observed in all instances.

4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.
8. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
9. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
 - a. Twelve (12) inches from power lines of <5-kVa.
 - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
 - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
 - d. Thirty-nine (39) inches from transformers and motors.
10. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

B. Horizontal Cabling in Modular Furniture:

1. This Contractor shall be responsible for providing and installing cable completely to the information outlet in the furniture. This Contractor's responsibility does not end at the furniture feed point.
2. Where furniture panels are installed to include contact with a wall, cabling shall be fed to the furniture panels via conduit.
3. Where modular furniture is installed without wall contact, the Contractor shall install cabling through floor fittings as shown on the drawings.
4. Cabling shall be protected in the transition from the floor or wall fittings to the modular furniture via a length of flexible plastic conduit or other approved protective means. Conduit fittings shall be compatible with the Floor and Wall Fittings proposed. There shall be no exposed cable in the transition to the modular furniture. Fill ratio (cable area vs. conduit area) in each feed shall not exceed 40%.
5. For purposes of bidding, it is to be assumed that the cable pathway shall be limited to the bottom panel of the modular furniture only. Communications cables would be run through these channels to the jack location.
6. For purposes of bidding, it is to be assumed that it will be the responsibility of the Contractor to punch and reinstall the bottom molding panels on the modular furniture as required to accommodate the communications cabling and information

outlets. The panels shall be marked prior to installation by the Owner to identify the desired location of the information outlets.

7. The information outlet shall be secured to the panel via mounting tabs, pop-rivets, screws or other approved method. Use of adhesive tape is not acceptable. The method of securing the information outlet to the panel shall not result in sharp protrusions (e.g., sheet metal screw tip) into the channel behind the panel.

3.2 CABLE TERMINATION REQUIREMENTS

A. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use.
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

B. Cable Terminations - RG-6 Coax:

1. All cables shall be terminated in the specified connector type. Coaxial cables shall be dressed neatly and secured to D-rings per manufacturer guidelines.
2. When preparing the RG-6 coaxial cable for termination, manufacturer's installation procedures shall be adhered to. Special care shall be taken to ensure the proper center conductor length as specified by the manufacturer.
3. All coaxial cable connectors shall be mated to the cable using only the appropriate purpose-designed tools recommended by the manufacturer for that purpose.

END OF SECTION

SECTION 27 17 10
TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

- A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:
 - 1. Complete information on testing procedure as described herein.
 - 2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

PART 2 - PRODUCTS

2.1 TESTING COPPER

- A. General Requirements:
 - 1. Perform acceptance tests as indicated below for each sub-system as it is completed.
 - 2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
 - 3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
 - 4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
 - 5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.

6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
 - a. CAT 6 Cable:
 - 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
 - 2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
 - 3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link" "Channel Link", including patch cords, cabling, and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
 - a) Wire Map
 - b) Length
 - c) NEXT Loss (Pair-to-Pair)
 - d) NEXT (Power Sum)
 - e) ELFEXT (Pair-to-Pair)
 - f) ELFEXT (Power Sum)
 - g) Return Loss
 - h) Attenuation
 - i) Propagation Delay
 - j) Delay Skew
 - 4) The maximum length of horizontal cable shall not exceed 295 feet (90m), which allows 33 feet (10 m) for technology equipment and modular patch cords.
 - 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation

data is available from the cable manufacturer for the exact cable type under test.

- 6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.
3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

C. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 27 17 20
SUPPORT AND WARRANTY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.2 RELATED WORK

- A. Section 27 05 00 - Basic Communications Systems Requirements.

1.3 QUALITY ASSURANCE

- A. Refer to Section 27 05 00 for relevant standards.

PART 2 - PRODUCTS

2.1 MANUFACTURER REQUIREMENTS

- A. The Basis of Design for all structured cabling components is listed in the individual Division 27 sections. Alternative acceptable manufacturers will be accepted for this project.
- B. Additional acceptable manufacturers for horizontal cabling:
 - 1. Panduit Netkey
 - 2. Belden
 - 3. Commscope/Uniprise
 - 4. Siemon
 - 5. Berk-Tek/Leviton
 - 6. Molex

2.2 WARRANTY

- A. A twenty-five (25) year Product Installation Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- C. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 28 05 00

BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.
- B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make their portion of the security systems a finished and working system.
- C. Description of systems include but are not limited to the following:
 - 1. Electronic access control system
 - 2. Video surveillance
 - 3. Fire detection and alarm
 - 4. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
 - 5. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
 - 6. Firestopping of penetrations of fire-rated construction as described in Division 7.

1.3 WORK SEQUENCE

- A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS

- B. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- C. Definitions:
 - 1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
 - 2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
 - 3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.

4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.
- D. General:
1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, cable tray, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.
 2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
 3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has convened to determine the exact location and requirements of the installation.
 4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Security Wiring, the installation shall not begin until the Security Contractor has completed a coordination review of the cable tray shop drawing.
 5. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Lighting Fixtures
 - b. Gravity Flow Piping, including Steam and Condensate
 - c. Sheet Metal
 - d. Electrical Busduct
 - e. Cable Trays, including 12" access space
 - f. Sprinkler Piping and other Piping
 - g. Conduit and Wireway
 - h. Open Cabling
- E. Electrical Contractor's Responsibility:
1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
 2. Assumes all responsibility for providing and installing cable tray.
 3. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- F. Security Contractor's Responsibility:
1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.

2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of security equipment which is required to be bonded to the telecommunications bonding system.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant

reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

- b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
 - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
- 10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
 - 11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.
 - 12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Qualifications:

- 1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
- 2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
- 3. 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.
- 4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.
- 5. A resume of qualification shall be submitted with the Contractor's bid indicating the following:

B. Compliance with Codes, Laws, Ordinances:

- 1. Conform to all requirements of the City of Colfax, IA Codes, Laws, Ordinances and other regulations having jurisdiction.
- 2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
- 3. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
- 4. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.

5. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
 6. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
- C. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
 2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
 3. Pay all applicable charges for such permits or licenses that may be required.
 4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
 5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
 6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
 7. All equipment, and materials shall be as approved or listed by the following:
(Unless approval or listing is not applicable to an item by all acceptable manufacturers.)
 - a. Factory Mutual
 - b. Underwriters' Laboratories, Inc.
- D. Examination of Drawings:
1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
 2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
 3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
 4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
 5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
 6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

- E. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
 2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
 3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
 4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
 5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
 6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
 7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
 8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.
- F. Field Measurements:
1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.
1. Submittals list:

Referenced Specification Section	Submittal Item
28 13 00	Electronic Access Control
28 23 00	Video Surveillance
28 31 00	Fire Detection and Alarm
- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:
1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Architect/Engineer
 - d. Contractor and subcontractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.

- 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
- d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
- e. **The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.**
- 6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
- 7. Schedule submittals to expedite the project. Coordinate submission of related items.
- 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
- 9. Reproduction of contract documents alone is not acceptable for submittals.
- 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
- 11. Submittals not required by the contract documents may be returned without review.
- 12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
- 13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
- 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
- C. Electronic Submittal Procedures:
 - 1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
 - 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 - 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 28 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 28 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.7 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
 2. Submit in Excel format.
 3. Support values given with substantiating data.
- C. Preparation:
 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
- D. Update Schedule of Values when:
 1. Indicated by Architect/Engineer.
 2. Change of subcontractor or supplier occurs.
 3. Change of product or equipment occurs.

1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.
- B. Change order work shall not proceed until authorized.

1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
 1. Firestopping, including mechanical firestop systems.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network

Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 REFER TO INDIVIDUAL SECTIONS

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

- A. General:
 - 1. Refer to specific Division 28 sections for further requirements.
 - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
 - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
 - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
- B. Protection of cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign

material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.

2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
 2. Refer to the end of Section 27 05 00 for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
 3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
 1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
 2. Submitted bound copies of approved shop drawings.
 3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
 4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
 5. Submitted testing reports for all systems requiring final testing as described herein.
 6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
 7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site insert address here; submit receipt to Architect/Engineer prior to final payment being approved.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div28.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- E. Refer to the individual specification sections for minimum hours of instruction time for each system.
- F. Operating Instructions:
 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
 2. If the Contractor does not have Engineers and/or Technicians on staff that can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM COMMISSIONING

- A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the

satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

3.10 CONSTRUCTION WASTE MANAGEMENT

- A. This Contractor shall comply with all construction and demolition waste disposal and recycling requirements outlined in LEED MRc2: Construction Waste Management (follow latest edition at the time of bidding or as referenced in these specifications).
 - 1. This Contractor shall coordinate with the General Contractor to develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled.
 - 2. The Contractor shall track waste disposal and recycling efforts throughout the construction process for all materials associated with this Contractor's scope of work. The Contractor shall provide this information to the General Contractor so

that it can be incorporated with similar information from all other contractors for the project.

- a. Calculations for waste and recycled material can be done by weight or volume, but they must be consistent throughout the project. The Contractor shall coordinate with the General Contractor to establish the preferred calculation method and report the results accordingly.
 - b. Excavated soil and land-clearing debris do not count towards the waste disposal or recycled material.
3. At a minimum, 50% of the construction and demolition debris for this project must be recycled or salvaged.

END OF SECTION

SECTION 28 13 00
ELECTRONIC ACCESS CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Server
- B. Client Workstations
- C. Field Control Hardware
- D. Application Software
- E. Access Control Graphical User Interface
- F. Credentials and Badging
- G. Portal Devices

1.2 RELATED WORK

- A. Section 08 71 00 – Door Hardware
- B. Section 26 05 13 – Wire and Cable
- C. Section 26 05 33 – Conduits and Boxes
- D. Section 26 05 35 – Surface Raceways
- E. Section 27 05 26 – Communications Bonding
- F. Section 27 05 28 – Interior Communication Pathways
- G. Section 27 05 53 – Identification and Administration
- H. Section 27 15 00 – Horizontal Cabling Requirements
- I. Section 28 05 00 – Basic Electronic Safety and Security System Requirements
- J. Section 28 23 00 – Video Surveillance
- K. Section 28 31 00 – Fire Detection and Alarm Systems.

1.3 QUALITY ASSURANCE

- A. Manufacturer: The manufacturer shall have a minimum of ten (10) years documented experience in the development and manufacture of access control software and hardware. The software developer shall be, at a minimum, a Microsoft Silver Certified Integrator and Partner for those systems that reside in a Microsoft environment.
- B. Contractor:
 - 1. Shall be a factory-authorized installation, service and support company specializing in the selected manufacturer's product, with demonstrated prior experience of a minimum of ten (10) years installing, programming and supporting the selected manufacturer's system.
 - 2. Shall have been in business for a minimum of ten (10) years and shall have installed a minimum of three (3) similar or larger sized systems. Contractor shall have a minimum of two (2) service technicians who are certified in the proposed manufacturer's system.
 - 3. Shall have as a regular, full time employee a minimum of one employee with the following certification(s) or education Should more than one certification be required, one employee may maintain multiple certifications.
 - a. A certification of RCDD from BICSI or CNIDP from CNet.

1.4 MATERIAL:

1. All material which is Contractor furnished shall be new, unused and free from defects.
2. Where more than one of any specified item of equipment or material is used, all such items shall be the same product from the same manufacturer.

1.5 REFERENCES

- A. International Building Code
- B. NFPA 70 – National Electrical Code.
- C. The BOCA National Building Code
- D. UL 294 – Standard for Access Control Systems.
- E. UL 464 – Standard for Audible Signal Appliances.
- F. UL 634 – Standard for Connectors and Switches for Use with Burglar Alarm Systems.
- G. UL 1449 – Standard for Surge Protective Devices.
- H. UL 1635 – Standard for Digital Alarm Communicator Systems.
- I. UL 1638 – Standard for Visual Signaling Appliances – Private Mode Emergency and General Utility Signaling.
- J. UL 1778 – Uninterruptible Power Systems.

1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 28 05 00.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
 2. All component options and accessories specific to this project.
 3. Electrical power consumption rating and voltage including UPS sizing.
 4. Heat generation for all power consuming devices.
 5. Wiring requirements.
 6. Server processor(s), workstation configurations, total and available disk space, and memory size.
 7. All network bandwidth, latency and reliability requirements.
 8. Backup/archive system size and configuration.
 9. Submit two of each type of credential to be used (access card, key fob, etc.).
- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where each controller will be located. This block diagram shall be provided in Adobe PDF.
 2. Provide a schedule of all controllers and the doors/points each controller controls. This schedule shall be provided in Adobe PDF.

3. Provide schedules describing each system input location by an architecturally familiar reference, e.g., Door 312A. The architectural door schedule shall be used as the basis. These schedules shall be provided in Adobe PDF
- D. Submit sample format of site-specific programming guides to be used for system planning/programming conference with Owner. These guides shall be provided in Adobe PDF.
- E. So that required Owner personnel are present at the planning/programming conference required in Part 3 of this section, submit meeting agenda for the conference a minimum of two weeks prior to the conference.
- F. Submit detailed description of Owner training to be conducted at project end, including specific training times. Refer to Part 3 of this section for details.
- G. IP Addresses: Contractor shall provide to Owner, in a documented transmittal and in Microsoft Excel format, the names and locations of devices which require an IP address. An authorized representative of the Owner shall furnish the addresses for the associated devices in Microsoft Excel format in a documented transmittal. Should Owner change the IP address structure after approval of the list, Owner may be responsible for additional fees involved with reprogramming.
- H. Quality Assurance:
 1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor. Provide documentation of the training and other applicable certifications of the Contractor.
 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

1.7 SYSTEM DESCRIPTION

- A. This section describes the furnishing, installation, programming and commissioning of a complete, turnkey access control system with integration to video surveillance system. The terms "access control system" and "security management system", or SMS, may be used interchangeably herein.
- B. Where applicable, the SMS shall be provided with the video surveillance system as a single-manufacturer solution, or a manufacturer-approved direct integration as described below.
- C. The company, manufacturer, and product names used in this section are for identification purposes only. All trademarks and registered trademarks are the property of their respective owners.
- D. Performance Statement: This section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required. The Contractor shall be responsible for determining quantities of materials required for a complete and operational system. Floor plan drawings and schedules have been developed to aid the Contractor in determining device quantities and installation locations, but, where discrepancies between floor plans and schedules arise, the greater number shall govern.
- E. Basic System Description:
 1. The access control system shall provide the following functionality:
 - a. Electronic control access to designated areas.

- b. Validation of cardholder credentials by use of personnel database, card formats. The system shall compare the time, location, and unique credentials of an attempted entry with information stored in the database.
- c. Access to designated areas will be validated only when a user's credential has a valid number for its facility and the number is valid for the current time and for the reader where it is used.
- d. The system software shall access the hardware that validates the person and monitors the security of a building by use of intelligent system controllers, reader interfaces, locks, readers, inputs and outputs. When access has been validated, a signal to the portal locking device shall be activated to enable alarm free access at that location.
- e. The system shall be configured by use of application software.
- f. The system shall monitor activities using operator monitoring software which includes graphical maps which display alarms, status and activity.
- g. The system shall differentiate and restrict administrative and operational access through use of password authentication.
- h. The system shall report on various aspects of the system by use of reports, both default and customizable. Reports shall be able to be printed.
- i. The system shall have the capability to report alarms both audibly and visually.
- j. The system shall control hardware from the monitoring station by use of manual actions and events.
- k. The system shall provide record and data management by use of journals. There shall be a full audit trail.
- l. The system shall allow for data to be imported from other products by use of database migration tools. These products may include Human Resources databases for name and/or time and attendance information, information from previous access control systems consisting of badge numbers from credentials that will be re-used, Microsoft Excel spreadsheets, or other systems as defined herein.
- m. The system shall allow access using a web interface or a mobile application for use on the iOS and Android operating systems.

F. Integrations, Software Development Kit (SDK) and Application Programming Interface (API):

- 1. The manufacturers of the systems that are integrated shall make an SDK available to other manufacturers.
- 2. Prior to the release of this section, the manufacturers of the systems that are to be integrated shall have made available to each other all APIs to perform the specific integrated functions required in this section.
- 3. The integrations shall be completed and tested and shall have been implemented on at least one system of similar size prior to the release of this section. The integrations shall not be accomplished for the first time for this project unless written pre-approval has been granted by Owner to Contractor prior to bid deadline.
- 4. During the warranty period, should a new API or version of software be released by the SMS manufacturer or any of the manufacturers of systems or devices that are integrated, that API or version of software shall be installed in the appropriate system or device defined in this section at no charge to Owner. Should any loss of functionality in the integration be exposed through this installation, as compared to

the accepted system, Contractor shall correct the functionality at no charge to Owner.

5. Any and all development costs for specified functionality or inter-system integrations shall be included in the Contractor's bid. No additional costs or fees for the integrations shall be charged to Owner from the time of notice to proceed through system acceptance.

1.8 OWNER FURNISHED MATERIAL

- A. Data circuit / internet service
 1. Routers
 2. Switches
 3. Hubs
 4. Wireless access points
 5. Uninterruptible power supplies for Owner furnished products

1.9 LICENSING REQUIREMENTS

- A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include server and workstation software, network controllers, card readers, printers, badging stations, and any other licensing that is required by the manufacturer for operation of any system component.
 1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each device requiring a license plus 10% growth. In the event the manufacturer requires the purchase of a block of licenses, license blocks provided shall be no greater than what is required for the number of devices in this project plus 10% growth. Contractor shall document the number of remaining licenses in the project record documents and Operations and Maintenance data.
 2. In addition to the licensing requirements listed above, provide licensing and configuration of system administration/operation software for 1 workstation. The workstation licenses shall be concurrent use seats, and the client software shall be able to be loaded on an unlimited number of workstations at no extra cost to the Owner. Contractor shall install client software on the same number of machines as licenses provided. As part of the training, Contractor shall demonstrate to Owner how to install client software on additional workstations.
 3. All Contractor-furnished software shall contain a perpetual, permanent license in which no other fees beyond the single payment for the work of this section are required in order to use the proposed software indefinitely. Owner understands that, after the initial warranty period has expired, maintenance and technical support fees may be required annually, quarterly, or monthly in order to receive software updates and technical support. However, it remains the option of Owner to purchase or decline this service. If Owner chooses to discontinue or never purchase this service, the software shall continue to be legally licensed for use. All software shall be the latest version released, and all Contractor-furnished servers and workstations shall be current on all patches and updates for all software on the machines at the time of acceptance of the associated systems.
 4. The SMS shall require only a single license key present on the server for the SMS to operate. The key shall be a physical device or a software key. License keys shall not be required at the client workstations.

1.10 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 28 05 00.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.

- C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.
- D. Provide schedules documenting:
 - 1. Controller installation locations including specific door numbers being controlled.
 - 2. All terminal block wiring, including cable numbers.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance data manuals as described below.

1.11 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 28 05 00.
- B. Manuals: Final copies of the manuals shall be delivered within 14 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system, and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. Manuals shall be submitted in electronic format only, Adobe PDF. The manuals shall consist of the following:
 - 1. Hardware Manual: The manual shall describe all equipment furnished including:
 - a. General description and specifications.
 - b. Installation and check out procedures.
 - c. System and equipment layout and electrical schematics to the control board and field device level. For multiple devices wired identically, only one wiring diagram is required per door configuration, to be labeled "TYPICAL".
 - d. Alignment and calibration procedures.
 - e. Manufacturers repair parts list indicating sources of supply.
 - 2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a. Definition of terms and functions.
 - b. System use and application software.
 - c. Initializations, startup, and shutdown procedures.
 - d. Reports generation.
 - e. Details on forms customization and field parameters.
 - 3. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - a. Computers and peripherals.
 - b. Log in/Log out procedures.
 - c. Use of system, command, and applications software.
 - d. Recovery and restart procedures.
 - e. Graphic alarm presentation.
 - f. Use of report generator and generation of reports.
 - g. Data entry.
 - h. Operator commands.

- i. Alarm messages.
 - j. System permissions functions and requirements.
- 4. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, cleaning, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.12 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
 - 1. Inspections: The Contractor shall perform two minor inspections at six-month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
 - 2. Minor Inspections: These inspections shall include:
 - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all equipment, including exterior surfaces and accessible and serviceable interior surfaces.
 - b. Perform diagnostics on all equipment.
 - c. Check, test, and calibrate (if required) all sensors.
 - d. Run all system software diagnostics and correct all diagnosed problems.
- C. Operation: Upon the completion of any scheduled adjustments or repairs, Contractor shall verify operation of the SMS.
- D. Service: The Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service personnel shall be at the site within 48 hours after receiving a request for service.
- E. Records, Logs and Work Requests: Contractor shall keep records and logs of each task completed under and outside of warranty. These logs shall be maintained in Microsoft Word or Excel. The log shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, description of work performed, the amount and nature of the material used, and the time and date of commencement and completion of the work. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the SMS. The Contractor shall deliver a record of the work performed within three (3) business days after work is completed. Defective items that have been replaced shall be given to the Owner. Should the replacement item be a temporary

replacement until the removed item is repaired, Contractor shall retain possession of the defective item for repair and subsequent re-installation.

- F. System Modifications: Modifications by the Contractor are allowed after system acceptance. Contractor shall make recommendations for system modification in writing to the Owner. No system modifications shall be made without prior, written approval of the Owner. Any modifications made to the system shall be incorporated into the Operations and Maintenance Manuals, and other documentation affected. The Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- G. Software: At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the warranty and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation.
- H. Refer to the individual product sections for further warranty requirements of individual system components.

1.13 ANNUAL SERVICE CONTRACT

- A. Provide annual cost for extended service and maintenance agreement after the first year for the access control system according to the following terms:
 - 1. The term of the warranty shall begin on the system acceptance date and shall continue for one (1) year. The extended service and maintenance warranty shall begin following this first year if accepted by the Owner. The term shall be automatically renewed for successive one-year periods unless canceled in writing by the Owner with Contractor confirmed receipt, up to the date of expiration. The service and maintenance agreement shall include the following basic services to the Owner, including all necessary parts, labor and service equipment:
 - a. Repair or replace any security equipment item that fails to perform as initially installed, as specified, or as determined per the manufacturer's performance criteria.
 - b. Perform preventive maintenance on the security equipment during the 6th month and 12th month of the service contract. This preventive maintenance shall include cleaning, realignment, inspection, and testing of security devices. The Owner shall receive a written report of these inspections that identifies the security system's status and, if required, a list of all necessary repairs or replacements.
 - c. Provide maintenance on the SMS system software. At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the service contract and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation. Contractor shall not be responsible for maintenance of Owner data.
 - 2. The Contractor shall be compensated for any repairs or maintenance provided as a result of Owner abuse, misuse, intentional damage, accidental damage, or power fluctuations exceeding specified equipment tolerances.

3. Service: The Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service personnel shall be at the site within 48 hours after receiving a request for service.
- B. Provide complete terms and conditions of warranty and service.
- C. The Owner will enter into a contract directly with the vendor. This specification section is not a contract between the Owner and the vendor to perform these services.

PART 2 - PRODUCTS

2.1 ELECTRONIC ACCESS CONTROL SYSTEM MANUFACTURERS

- A. Avigilon
- B. S2
- C. Lenel
- D. Genetec
- E. Should the access control manufacturer offer, as an option, the use of hardware by Mercury Security, the Contractor proposed solution shall utilize this hardware. Contractor shall state whether or not the software is compatible with the SCP, AP and EP families of Mercury Security hardware. For future additions or defective hardware replacements, the system shall not be "locked" to require Mercury Security hardware be purchased only from the access control software manufacturer or from the original Installing Contractor.
- F. Approval of Alternate Manufacturers:
 1. Contractors seeking approval for alternate manufacturers for any devices or software in this section shall submit requests for approved equals as defined by Division 1 in addition to submitting:
 - a. Bill of materials for each piece of hardware and software proposed.
 - b. Manufacturer's data sheet for each piece of equipment proposed.
 - c. Line-by-line typewritten statement of compliance or non-compliance comparing Part 2 of this section with the published specifications of the proposed alternate products. This compliance statement shall be signed by an officer of the local contractor branch office that proposes to install the alternate product and either an officer of the manufacturer or an officer of the manufacturer's representative.
 2. Refer to the project drawings for manufacturer and model numbers for the Basis of Design products.

2.2 SERVER

- A. The system shall not be required to have a traditional or virtual server and, instead, may be provided with embedded server functionality integral to the controller if the following three (3) conditions are met. The server specified below shall apply if the system does not meet these three (3) conditions:
 1. The network controller is a distributed architecture, native IP network appliance.
 2. The network appliance contains an onboard, embedded operating system (e.g., Linux-based), web server, ODBC-compliant database engine, data storage device and application logic controller.
 3. The network appliance contains onboard SSL communications.

- B. If the system architecture utilizes traditional servers, the system shall be a true multi-tasking, multi-threading application system architecture designed specifically for the Windows environment. All modules, including access control, alarm monitoring, credential management, etc., shall be built from a single unified 32-bit source code set.
- C. The system shall communicate on a TCP/IP based Ethernet LAN capable of utilizing 10/100/1000 BaseT.
- D. The system shall be functional in a virtual server environment.
- E. Provisioning:
 - 1. The server shall be furnished by the Contractor and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall coordinate with Owner for possible requirements to utilize a specific manufacturer. Contractor furnished server shall have a three (3) year limited warranty.
 - 2. Acceptable manufacturers of Contractor-furnished server are:
 - a. Dell – Basis of Design Power Edge R730 Series
 - b. HP
 - c. Iomnis
 - d. Approval of Alternate Manufacturers:
 - 1) Contractors seeking approval for alternate manufacturers for the server in this section shall submit requests for approved equals as defined by Division 1 in addition to submitting:
 - a) Bill of materials for each piece of hardware proposed.
 - b) Manufacturer's data sheet for each piece of equipment proposed
 - c) Line-by-line typewritten statement of compliance or non-compliance comparing Part 2 of this section with the published specifications of the proposed alternate products. This compliance statement shall be signed by an officer of the local contractor branch office that proposes to install the alternate product and either an officer of the manufacturer or an officer of the manufacturer's representative.
 - 2) Refer to the project drawings for manufacturer and model numbers for the Basis of Design products.
- F. Hardware:
 - 1. Enterprise class server.
 - 2. Rack mount configuration, or as provided direct by manufacturer.
 - 3. Six (6) USB 2.0 ports, one (1) two port 10/100/1000 Ethernet NIC.
 - 4. Dual, redundant, hot swappable power supplies.
 - 5. RAID Level 5 configuration with separate drives for data base, 500GB, and operating system, 500GB. One spare hot swappable hard drive for the database and one for the operating system.
 - 6. Enterprise class hard drives, minimum 7200 RPM, 3.5" SATA, minimum mean time between failure, MTBF, 1.2 M hours, 100% duty cycle 24x7.
 - 7. 8 GB RAM.
 - 8. Internal DVD+/- RW ROM SATA drive.

9. On board HDMI video card.
10. Predictive failure analysis.
11. Two (2) cooling fan modules, each with two fans, hot swappable.
12. Backup Power:
 - a. Contractor-Furnished Uninterruptible Power Supply (UPS):
 - 1) Line interactive, simulated or true sine wave.
 - 2) The critical load is normally supplied by utility power, and internal batteries are simultaneously float charged. The UPS shall boost or buck the voltage as needed, caused by fluctuations in utility voltage. Upon utility power failure, the UPS shall automatically switch to supplying load power from the batteries and internal inverter.
 - 3) Manufacturers:
 - a) APC: Smart UPS Series
 - b) Minuteman Pro-LCD Series
 - c) Emerson/Liebert
 - d) Eaton
 - e) Approved Equal
 - 4) Compliance:
 - a) Surge Suppression: ANSI C62.41
 - b) Safety: UL 1778
 - c) EMC: FCC Part 15
 - 5) Hot swappable batteries.
 - 6) Battery Capacity: Capable of operating at full load for 15 minutes.
 - 7) Rack mount.
 - 8) Input of 120 VAC, single phase, two wire plus ground.
 - 9) Supports external battery pack.
 - 10) Outlet Receptacles: Minimum six (6) NEMA 5-15R receptacles.
 - 11) Web browser or SNMP monitoring.
 - 12) Operating ambient temperature of 32°F to 104°F.
 - 13) Relative humidity 0% to 95% non-condensing.
 - 14) Internal input circuit breaker.
 - 15) Audible alarms for low battery warning, internal faults, overload, weak/dead battery.
 - 16) Transfer time of 6 m sec typical.
 - 17) Emergency Power Off (EPO) switch.
 - 18) Modes of Operation:
 - a) Normal/On-line – critical load is supplied by AC source; harmonics are filters and batteries are float charged
 - b) Boost – with a sag in utility power from 90 VAC to 105 VAC, UPS shall boost the voltage until AC source rises to 112 VAC

- c) Buck – with a swell in utility power ranging from 130 VAC to 150 VAC, UPS shall buck the voltage until AC source drops to 125 VAC
 - d) Battery – upon failure, brownout or overvoltage of AC power, the load shall be supplied power from the UPS batteries and inverter
 - e) Recharge – batteries shall be recharged to 90% capacity within 8 hours after return of normal AC power from low battery cut off
 - f) DC start – UPS shall start and operate without AC power applied
- G. The SMS software shall utilize the native Windows security features and be registered with the Windows operating system as a service. The security features shall be configured with the following layers:
 - 1. Workstation: Prohibits non-operators from accessing the system.
 - 2. Desktop: Controls which applications a given operator can run.
 - 3. Applications Commands: Controls which commands within an application a given operator can perform.
 - 4. Files: Controls an operator's read/write access rights to individual files.
 - 5. Breakthrough Alarms: The operating system shall allow high priority alarm condition notification regardless of the application software currently opened.
- H. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator/operator to learn a different and/or new interface from the previous version.

2.3 CLIENT WORKSTATIONS

- A. Provisioning:
 - 1. The workstation(s) shall be furnished by the Contractor and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall coordinate with Owner for possible requirements to utilize a specific manufacturer. Contractor furnished workstation(s) shall have a three (3) year limited warranty.
 - 2. One workstation shall provide SMS configuration, badging and video surveillance functions.
- B. Hardware:
 - 1. Desktop configuration
 - 2. Pentium 4 Dual Core CPU, 2.5 GHz or greater
 - 3. 4 GB RAM
 - 4. 100GB hard drive, 7200 RPM
- C. Operating System:
 - 1. Windows 10

2.4 FIELD CONTROL HARDWARE

- A. Interior Control Panels:
 - 1. Control boards, power distribution and terminals shall be enclosed in a NEMA 1. Contractor shall not furnish padlock. All enclosures that are part of this project shall

- be keyed alike. Contractor shall furnish and install a mechanically fastened tamper switch on the interior of the enclosure.
2. Control boards are allowed to be in an enclosure separate from the power supplies/power distribution. Should they be in separate enclosures, the interface wiring shall be in rigid metallic conduit, RMC, with Myers hubs at both ends of the conduit.
 3. Intra-enclosure wiring shall be dressed using tie wraps and/or covered plastic wire way. Hook-up wires for identical purposes shall have the same color insulation. For example, if one input pair utilizes green and white insulated conductors, all similar inputs shall use green and white insulated conductors. The same color scheme shall be followed for all access control panels that are part of this project.
 4. Cabling from field devices such as readers, door position switches, request-to-exit devices and locking devices shall not be directly terminated to the control boards and power supplies. The field devices shall be terminated to terminals located on the left side, right side or both sides of the enclosure back panel. Intra-enclosure wiring shall be routed from the terminals to the control boards and power distribution. Quantity and functional sequence of the terminals shall be identical portal to portal.
 5. All devices inside the enclosure, less cabling and batteries, shall be mechanically fastened to a removable solid or perforated metal back panel with either:
 - a. Metal or plastic standoffs
 - b. DIN rail
 6. Hook and loop fasteners, double sided tape or adhesives are not allowed to attach devices to the back panel. Mounting devices to the interior of the door shall only be allowed when the following two (2) conditions are met:
 - a. The access control hardware manufacturer offers prefabricated enclosures with devices mounted to the interior of the door.
 - b. Only the same devices that the access control manufacturer mounts to the interior of the door are allowed to be mounted in a different enclosure, and those devices shall be mounted in an identical manner.
 7. 120V 20A input power shall be hard wired to a circuit breaker disconnect and to one duplex receptacle on the interior of the enclosure. Should devices in the enclosures require plug-in transformers/power supplies, the receptacle shall be utilized. One (1) power strip with integrated circuit breaker shall be located in the bottom of the enclosure as needed.
 8. Power to the locking devices shall be provided by a power distribution board with no fewer than four (4) outputs. Each lock shall be individually protected. The power distribution board shall:
 - a. Provide protection with fuses or positive temperature coefficient (PTC) devices.
 - b. Provide control so that each output is individually selectable as latching or non-latching with fire alarm activation.
 - c. Provide control so that each output shall have Fail Safe and Fail Secure terminals.
 - d. Provide a fire alarm input with associated trigger LED.
 - e. Provide an individual LED per output to indicate when an input has been triggered and the associated output has been activated.
 - f. Accept a dry, closed contact input to activate the individual lock outputs.

- g. Provide a dry, Form C relay that energizes on activation of the fire alarm input. This output may then be used as a fire alarm input to other power distribution boards in the same or a different enclosure or may provide input to another device such as a multi-pole relay.
- 9. A minimum of four (4) 12V 7 AH rechargeable, sealed, lead acid batteries shall be located in the bottom of the enclosure. Two of the batteries shall be connected in series for 24V devices, and two batteries shall be connected in parallel for 12V devices. Contractor shall provide additional batteries as needed to power all devices for a minimum of 48 hours. Connections to the batteries shall be made with appropriate terminals crimped on the connecting conductors. Batteries shall be clearly labeled in a permanent manner with the date of installation.
- 10. Power to control boards, readers and auxiliary devices such as request-to-exit motion detectors shall be provided by a power distribution board with no fewer than four (4) outputs. All devices powered by the same voltage at an individual portal shall be protected by the same fuse or PTC unless current requirements dictate otherwise. Individual fuses or PTCs may protect more than one control board.
- 11. All access control panels, when populated with control boards and power supplies, shall have the following capacities:
 - a. Control of a minimum of two (2) portals.
 - b. Spare capacity of a minimum of one (1) access control portal, two (2) auxiliary inputs and two (2) auxiliary outputs greater than the requirements of the project at the time of system specification.
 - c. Five (5) spare fuses of each type used, to be in their original packaging, to be located in each power supply enclosure.
 - d. 50% spare current capacity on all power supplies located in unconditioned spaces and 40% spare capacity for those in conditioned spaces. Lower spare capacities are allowable based on prior approval of Contractor-provided power calculations.
- 12. Locations where enclosures may be mounted are shown on the plans. Final location, with approval of Owner's representative, shall be selected by Contractor based on distribution of controlled portals and devices.
- 13. At time of Substantial Completion, Contractor shall furnish a schematic diagram of intra-enclosure wiring and a complete bill of materials for the enclosures and the devices located within. This documentation shall include a schedule of fuses and the device(s) that each fuse protects. This documentation shall be placed by Contractor in a Contractor-furnished print pocket located on the inside of the enclosure door.
- B. Intelligent System Controllers (ISC):
 - 1. The controller shall communicate with the host via an on board 10/100 Base T Ethernet port.
 - 2. The controllers shall be a distributed architecture with full peer-to-peer networking capability. Master/Slave controller configurations are not acceptable. All controllers in the system shall be capable of operating in a standalone mode if communication is lost with the server or main controller. In no case shall a controller depend on communication with an upstream controller for proper standalone operation.
 - 3. The communications bus shall be supervised for wiring integrity. If a communication failure is detected, the system shall report the loss. All controllers unable to receive communication shall operate as standalone devices including grant/deny decisions, complete with event buffers. All events shall be uploaded to the server upon restoration of communications.

4. The controllers shall utilize flash memory or similar technology, allowing program updates to be downloaded from the server. Program storage shall be in ROM.
 5. The controllers shall have the capacity for 15,000 cardholders and 45,000 transactions. All access decisions involving these cardholders shall be made at the lowest controller level without communication to the server.
 6. 32-bit microprocessor controlled.
 7. Handle all non-host related access control monitoring and decision making.
 8. LED indicators for power, fault and communications.
 9. Provide for local and global input/output linking:
 - a. The SMS shall support a global linkage feature whereby any input/output/event shall be linked to any other input/output/event in the SMS. Input/output linkages shall be able to span across intelligent system controllers.
 - b. System administrators shall be able to create global input/output function lists, each consisting of a sequence of actions to be performed, such as changing card reader modes, activating outputs, and opening or closing anti-pass back areas. Each function list may include up to six actions.
 10. Reporting of transactions and status information to the server.
 11. Interface with standard reader technologies without special interface hardware, additional logic panels or other integrators. Supported technologies shall include:
 - a. 13.56 MHz Contactless Smart with or without biometrics or keypad
 - b. 13.56 MHz Multi-technology Smart
 - c. Proximity, with or without keypad
 - d. Magnetic stripe, with or without keypad
 - e. Wiegand
 - f. Bar code
 - g. Keypad
 - h. Biometric, with Wiegand output
- C. Reader Interface Module (RIM):
1. Reader interface modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of reader interface modules required based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
 2. RIM shall interface with and accept data from TTL, Wiegand and RS-485 type readers and door hardware.
 3. RIM shall provide a minimum of three (3) inputs per portal for portal position, request to exit and auxiliary input.
 4. RIM shall provide a minimum of two (2) outputs per portal for locking device and auxiliary output. Each output shall be Form C and shall be rated at 3A at 28VDC.
 5. RIM shall communicate to controller by RS-485.
- D. Input Control Module (ICM):
1. The input control module shall provide supervised and non-supervised alarm input zones and monitor/report line fault conditions, alarm conditions, power faults and tampers.

2. Input control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of input control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.
3. UL 294 and 1076 listed.
4. Each input configurable for normally open or normally closed.
5. Each input configurable for timing.
6. Each input configurable for end of line resistance.
7. Status LEDs for communication to the host, heartbeat and input status.
8. Communications line supervision.
9. AES 128 bit encryption.
10. 2-wire RS485 communications.
11. No fewer than eight (8) inputs per board/control module.
12. Assignment of unit addresses and communications speed.
13. Alarm Masking: The ability to mask the alarm input on a time zone basis.
14. Activate Output: The ability for any input to activate any output.
15. Configuration of Debounce Time: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
16. Elevator control support for number of floors shown on the drawings.
17. Noise rejection filtering to prevent false alarms.
18. Global Linkage: The ability to link outputs with inputs that are attached to any ICM/output control module (OCM).
19. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
20. Entry/Exit Delay: The ability to set up entry/exit delays for inputs that are attached to any ICM. This shall include:
 - a. Non-Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
 - b. Latched Entry: When an input activates, the alarm will not be reported until the entry delay expires. If the input is still active when the entry delay expires and the alarm has not been masked, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
 - c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

E. Output Control Module (OCM) and Functionality:

1. Output control modules are not shown on the plans. Refer to the installation section of this specification for allowable equipment mounting locations. It is the responsibility of the Contractor to determine the number and configuration of output control modules required, based on the inherent characteristics of each product line and the requirements and restrictions described in this document.

2. The output control module(s) shall provide Form C relay contacts for load switching, rated at 3A at 28VDC.
3. Each relay shall support "On" "Off" and "Pulse."
4. Outputs can be pulsed from 0.1 seconds to 24 hours.
5. Status LEDs for communication to the host, heartbeat and relay status.
6. 2-wire RS485 communications.
7. No fewer than eight (8) outputs per board/control module.
8. Communications line supervision.

2.5 APPLICATION SOFTWARE

A. General Performance:

1. The application software, in conjunction with the associated hardware, shall have the following features, functionality and capabilities. The functions that are to be implemented shall be determined in the planning conference between Contractor and Owner referenced in Part 3 of this section.
2. All Users:
 - a. All users shall be capable of being authenticated against Active Directory using LDAP before being granted system access. Should the Owner not use Active Directory, the system shall provide a built-in login and credential management tool to permit rules-based access rights on a per-user basis.
 - b. The access rights shall be selectable on a per-user basis. In addition, user groups shall be capable of being assigned whereby each user group has a common set of access rights. Users shall be capable of being assigned to these user groups by the system administrator.
3. Operators:
 - a. The SMS operator interface shall be standard Windows style graphical interface allowing point and click access to features such as drop-down menus, radio buttons, check boxes, list boxes and other standard Windows components.
 - b. On-line Context Sensitive Help: The SMS shall provide on-line context sensitive help files to guide system administrators and system operators in the configuration and operation of the SMS. The help menu shall be available from any window in the SMS by pressing one function key or clicking on the "HELP" icon/selection in the toolbar. Help windows shall be context sensitive so operators and system administrators can move from form to form without leaving the help window. The SMS shall come with complete on-line documentation on CD or the ability to offload the documentation to removable media.
 - c. Operator Groups: A minimum of 32 operator groups, allowing specific system module privileges to be accessed with each module being granted specific views, edit and execute privileges.
 - d. The SMS shall allow a system operator to login over another system operator who is already logged into the same client workstation without the need to reboot the system. This process shall log the first system operator off alarm monitoring and log the new system operator on, changing any permission necessary for that system operator.

4. Logs, Status, Maintenance, Diagnostics:
 - a. Historical Log: The system shall allow event history to be written to the hard disk in an archive format. At a minimum, the system shall support 500,000 transactions. Warning messages shall be generated at a user defined level of capacity. The system shall have the ability to offload the archive files to removable media automatically or manually.
 - b. System Status: The system shall query the status of any or all of the system's access control points, inputs and outputs.
 - c. System Maintenance/Diagnostics: The system shall provide for remote diagnostic capabilities. In addition, online diagnostics and communications maintenance shall be able to be activated from the operator interface.
5. Administrator:
 - a. The SMS shall provide system administrators with the ability to segment their access control SMS field hardware devices into various zones or areas where alarm monitoring client workstations will monitor. These zones shall be assigned an alphanumeric name using up to a minimum of 64 characters.
 - b. The SMS shall allow other devices such as card readers, input and output modules and intelligent system controllers to be automatically part of the monitoring zone when an intelligent system controller is selected, and it shall allow the system administrator to define which devices such as card readers, etc. belong to that monitor zone.
 - c. Updating of monitor zones shall take place in real time and without requiring operators to re-login.
6. General:
 - a. Elevator control support for the number of floors and cabs shown on the drawings.
 - b. The SMS software shall be written to Microsoft's published standards for user interface design, secure coding practices and database implementation guidelines such as Microsoft Open Database Connectivity (ODBC) interface.
 - c. All tasks shall be accessible from any compatible client workstation on the network using one or all of the following:
 - 1) Traditional client/server architecture.
 - 2) N-Tier architecture where the SMS shall support the expansion of the system architecture and allow for end-user deployment. The SMS shall allow, but not require, the separation of the database, application server, web server and client interface. The system shall require that all connections to the database be performed through a trusted link from the client or internet browser interface.
 - 3) Centralized publishing of applications using Windows Terminal Server and Citrix through any compatible internet browser application and/or by mobile computer including tablet PC.
 - d. The SMS shall use an open architecture where all data must reside on a single database and must be accessible in real time to every SMS workstation or web-based client connected to the network. The system database shall be used to create and maintain the cardholder database. A screen designer module shall allow the creation and editing of custom database tables and data entry screens.

- e. The SMS shall be able to connect to and interface bi-directionally with external data sources using all of the following methods:
 - 1) ASCII with support for XML-formatted text exchange of data activated both manually and automatically.
 - 2) ASCII with support for XML-formatted text exchange of data using a direct table interface activated both manually and automatically.
 - 3) Real time exchange of data via Active Directory/LDAP utilizing an API supported by the SMS manufacturer. The live exchange of data shall permit exposure of SMS events and transactions to other data sources in real time and allow for receipt of data into the SMS, permitting this data to be acted upon and trigger linked events in the SMS in real time.
- f. Security: Access privileges within the application software shall be permitted by use of a password protection system. The cardholder database shall have the following password security levels.
 - 1) A minimum of six (6) unique operator access levels
 - 2) Ability to view only the database fields
 - 3) Ability to restrict operator viewing to any of the individual database screens within a record
 - 4) Ability to restrict operator viewing to any of the database partitions
- g. Cardholder Configurations: The system shall have the capacity to support a minimum of 10,000 cardholder files. Each cardholder shall be capable of having up to five (5) access levels actively assigned to their account.
- h. The system shall have cardholder identifications for "Visitor" and "Escort", with an associated optional validity period assignable with an activation and deactivation date.
- i. The cardholder database screen shall have the following data associated with each cardholder:
 - 1) Last edit by operator with edited date and time
 - 2) Last date/time card was used
 - 3) Last reader giving valid access
 - 4) Last reader denying access
 - 5) Anti-pass back status
- j. The system shall provide advanced query capability with the following search criteria: equal to, not equal to, greater than, greater than or equal to, less than, less than or equal to, like, is empty, is not empty, is between, and, or, not.
- k. Access Control Configuration: The configuration application shall be password protected, restricting what each individual may edit or display inside the configuration application.
- l. Text descriptions of access points such as doors.
- 7. Time Zones:
 - a. The SMS shall be capable of creating and storing up to 255 time zones. Each time zone shall have a minimum of six (6) intervals. Each interval shall be assignable to any day of the week.
 - b. Each time zone shall be assignable to an alphanumeric name. Time zones shall be applied to access levels, card reader modes, alarm inputs, alarm

outputs, and alarm masking and logging functions. Time zones shall be allowed to belong to any or all access levels so that the time zone only has to be defined once.

8. Access Levels:

- a. The SMS shall be capable of defining a minimum of 32,000 access levels with a minimum of 32 access levels per cardholder per database segment. Access levels shall consist of a combination of card readers and time zones.
- b. Each access level shall be assignable to an alphanumeric name.
- c. Card readers shall have the ability to be assigned to any or all access levels defined in the SMS. Individual card readers shall be capable of having a distinct time zone assigned to it.
- d. The SMS shall allow an 'Allow User Commands' option to be assigned on a per access level basis where keypad readers are in use.
- e. The SMS shall allow a 'First Card Unlock' option to be assigned on a per access level basis. First Card Unlock feature, when configured, retards a pre-determined time zone activated unlock command until a valid credential has been presented and granted access to the portal.

9. Temporary Access Levels:

- a. The SMS shall be capable of assigning temporary access levels inclusive of the 32,000 assignable access levels.
- b. Each temporary access level shall be assignable to an alphanumeric name.
- c. Each temporary access level shall be definable with a start and end date.
- d. Temporary access levels shall be stored in the ISC, and functionality shall be maintained in the event of disconnection with the ISC.

10. Access Groups:

- a. The SMS shall be capable of assigning access groups, with a maximum of 32 access levels per access group.
- b. Each access group shall be assignable to an alphanumeric name.

11. Precision Access Levels:

- a. The SMS shall be capable of assigning precision access levels in addition to the 32,000 access levels, with the ability to assign unlimited card reader and time zone combinations. Precision access levels provide capability of assigning a unique access level on a per card basis.
- b. Each precision access level shall be assignable to an alphanumeric name.

12. Holidays:

- a. The SMS shall provide a minimum of 255 holiday assignments using an embedded calendar. Holidays shall be assigned an alphanumeric name and shall be grouped into eight (8) types of holidays and shall be assignable to individual time zones. Access rights, card reader modes, and alarm masking schedules must be able to be altered when the current date is designated as a holiday.
- b. Dates for Daylight Saving Time changes shall be definable and shall take effect automatically.
- c. The SMS shall support holiday ranges that allow a single holiday to span across multiple calendar days.

13. Database Segmentation:

- a. The SMS shall be required to support data segmentation whereby each segment shall have its own set of cardholders, field hardware, and system parameters (time zones, access levels, etc.). This segmentation shall expand the limitations of the SMS parameters (e.g., access levels and time zones) to the maximum capacity of each parameter multiplied by the number of segments. The following list shall be made available for segmentation:

- 1) Access group
- 2) Access levels
- 3) Actions
- 4) Action groups
- 5) Alarm inputs
- 6) Alarm mask groups
- 7) Alarm outputs
- 8) Areas
- 9) Credential types
- 10) Card formats
- 11) Cardholders
- 12) Card readers
- 13) Central station receivers
- 14) Device groups
- 15) Digital video archive servers
- 16) Fire alarm panels
- 17) Guard tours
- 18) Global I/O function lists
- 19) Global I/O links
- 20) Holidays
- 21) Intercom panels
- 22) Intercom stations
- 23) Intrusion detection panels
- 24) ISCs
- 25) Maps
- 26) Monitor zones
- 27) Precision access groups
- 28) Receiver accounts
- 29) System operators
- 30) Time zones
- 31) Tour groups
- 32) Visitors
- 33) User permission groups

14. Field Hardware Communications:
- a. The SMS shall support communications with the intelligent system controllers (ISCs) by the following protocols:
 - 1) RS-232
 - 2) RS-485
 - 3) TCP/IP
 - 4) Dial-up modem
 - b. Communication baud rate shall be system selectable with a range between 1,200- to 115,200 bits per second.
 - c. Download communication between the SMS and the ISC shall be fully multi-tasking and shall not interfere with operational functions.
 - d. Upon loss of communications between the SMS server and the ISC, an alarm shall be created with a time stamp. Upon re-established communication, the SMS and the ISC shall automatically re-synchronize from the point of communication loss without operator intervention.
15. Dual Path Field Hardware Communication:
- a. The SMS shall support dual path communications between the SMS server and the ISCs. This shall allow for a redundant communication path in the event the primary path fails. The secondary path shall support all primary path protocols.
 - b. In the event of a communication failure of the primary path, the ISC shall initiate a switchover to the secondary path. During this fail switchover period, the ISC shall periodically check to see if the primary path has been re-established and will automatically switch back upon a successful connection. Alarms shall be generated upon loss or restoration of communications.
16. Intelligent System Controller Remote Support:
- a. The SMS shall support remote operations to and from the intelligent system controller (ISC). The remote connection shall be either a constant connection or a scheduled connection. If the connection is constant, then every panel shall have its own connection at the host. If the connection is scheduled, then all panels using remote connections shall have the ability to share the same host connection(s).
 - b. System administrators shall have the ability to define the remote connections available in the pool. For each connection, system administrators shall be able to define the connection type and the client workstation to which it is installed.
 - c. Remote sessions shall occur under any of the user defined scenarios:
 - 1) On Demand Connection: A system operator shall have the ability to automatically initiate a remote session to an ISC via the alarm monitoring module.
 - 2) Scheduled Connection: System administrators shall have the ability to configure the SMS so that the ISC remotes into the SMS at pre-determined times through use of time zones.
 - 3) Critical Alarm Activated: System administrators shall have the ability to configure the SMS so that the ISC initiates a remote session with the SMS when a critical alarm is activated in the field.

- 4) Buffer Threshold: System administrators shall have the ability to configure the SMS so that the ISC initiates a remote session with the SMS when a pre-determined number of events are stored in the ISC memory buffer.

17. Area Control:

- a. Area control shall be a security method of preventing a person from passing their credential to another person for dual entry into a single location using one card. The SMS shall support the following area control features.
- b. Global Hard Anti-Pass Back:
 - 1) The Global Hard Anti-Pass Back feature shall require that a credential always be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Hard Anti-Pass Back shall work in the following manner:
 - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be denied access and an alarm shall be reported to the alarm monitoring client workstation. Nested control areas (areas inside areas) shall be definable with a minimum of 64 entry and exit card readers. It shall be possible to have an area within an area and/or multiple areas that are independent of each other in which Global Hard Anti-Pass Back rules shall apply.
- c. Global Soft Anti-Pass Back:
 - 1) The Global Soft Anti-Pass Back feature shall require that a credential be used to enter and exit an area. The controlled areas shall have both entry and exit card readers at all portals. Entry and exit readers shall be able to span across multiple ISCs. Areas shall be logically defined under the SMS, and area control shall not be required at all areas. Global Soft Anti-Pass Back shall work in the following manner:
 - a) A cardholder must present his/her credential at the entry card reader of the area that the person wishes to enter. Once access has been granted into the area, the cardholder cannot present the credential to another entry card reader within the same area without first presenting his/her credential to the respective exit card reader of that area. Should a cardholder attempt to use any other card reader in the same area besides the occupied area's exit card reader once access has been granted to that area, the cardholder shall be allowed access (if that cardholder has the appropriate access level to access the new area),

and an alarm shall be reported to the alarm monitoring client workstation. It shall be possible to have an area within an area and/or multiple areas that are independent of each other.

d. The following summary criteria shall apply under Global Hard or Soft Anti-Pass Back:

- 1) Initially all card holders are reset to Area 0.
- 2) Any cardholder shall enter a controlled area any time after Time 0 by presenting a credential to a SMS entry card reader.
- 3) A cardholder shall not exit the controlled area unless he/she has entered the area presenting a credential to the SMS entry card reader.
- 4) A cardholder shall not enter the controlled area a second time unless the cardholder has exited that area previously.
- 5) A cardholder shall be able to enter through any entry card reader and exit through any exit card reader of a single controlled area.
- 6) These options shall include a "forgiveness" feature that will allow the system administrator to reactively reset the anti-pass back of all cardholders to Area 0, either through a manual override or a time zone command.
- 7) The SMS shall provide an anti-pass back exempt option for privileged or VIP cardholders. Cardholders with this option will not have anti-pass back rules applied to them.
- 8) The SMS shall also have a "forgiveness" feature that will allow the system administrator to proactively assign an automatic reset to an individual cardholder. This shall allow the system administrator to reset the anti-pass back of an individual cardholder to Area 0 automatically for a defined number of times.

e. Timed Anti-Pass Back:

- 1) Timed Anti-Pass Back shall allow the system administrator to decide how long after a cardholder has presented their credential that they will have to wait before the same credential will be accepted again at the same card reader. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.

f. Two-Person Control:

- 1) Two-Person Rule shall be provided to restrict access to certain areas unless there are two (2) cardholders present. This restricts individuals from being alone in restricted or highly secure areas. When an area is configured for Two-Person Rule, the following criteria shall prevail:
 - a) The card reader shall grant access only if two valid cardholders (with authorized access levels) swipe their credentials one after the other. In the event a second authorized card is not presented within 10 seconds of the first authorized credential, the card reader shall reset and the first card will have to be swiped again.
 - b) Once two people occupy an area, individual access shall be granted.

- c) Individual exit shall be permitted until an area is occupied by only two cardholders, at which point the Two-Person Rule applies for exit.
- g. Occupancy Limit:
 - 1) Occupancy Limit shall restrict the number of cardholders that shall be present in an area at any given time. The Occupancy Limit area shall be able to be defined by the system administrator up to the limits of the cardholder capacity of the system. Once the occupancy limit has been reached, a cardholder must swipe out of the exit card reader before the next cardholder may enter. Each area for which Occupancy Limit is enabled shall be definable with up to 64 entry/exit card readers. Multiple Occupancy Limit areas shall be definable.
- h. Mustering:
 - 1) The SMS shall support Mustering functionality. The Mustering function shall provide an automatic capability for registering cardholders that are on site during an incident. Designated exit and entry card readers shall be used to enter and leave hazardous locations and safe locations. When an incident occurs, a muster report shall be generated that consists of a listing of all personnel that are within the hazardous locations, as well as all personnel that have registered in a safe location.
- i. Alarm Masking Groups:
 - 1) The SMS shall support a group alarm masking feature whereby system administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple input control module inputs and card reader inputs simultaneously.
 - 2) The following events shall have the ability to be part of an alarm masking group:
 - (1) Input Control Module Events
 - (2) Alarm Input Active
 - (3) Card Reader Events
 - (4) Auxiliary Input Active
 - (5) Denied Count Exceeded
 - (6) Door Contact Tamper
 - (7) Door Forced Open
 - (8) Door Held Open
 - (9) Card Reader Input Tamper
 - a) Alarm Masking Groups shall be able to be masked as a group or as individual points.
 - b) Alarm Masking Groups must support the ability to be masked multiple times. Alarm Masking Groups shall be able to be masked and/or unmasked via alarm monitoring commands by guards, via card reader keypad function keys, or via global linkage commands.
 - c) The SMS shall support "2-man control" for masking Alarm Masking Groups.

- d) The SMS shall support an Alarm Masking Group status change (masked to unmasked or unmasked to masked) action to be linked to a function list that is capable of performing many system actions, such as activating a relay output. The SMS shall support a minimum of 64 Alarm Masking Groups per intelligent system controller. with a minimum of 200 alarm inputs per Alarm Masking Group.
- j. Cardholder Escort Control:
 - 1) The SMS shall support comprehensive escort functionality based upon access levels. Access levels shall include options for "Escort Required", "Designated Escort", "Not an Escort" and "Does not require an Escort." Contractor shall integrate escort level and designation into badge design in cooperation with Owner.
 - 2) The escort feature shall be capable of one-to-one and one-to-many Escort to Escorted functionality.
- k. Cardholder Use Limits:
 - 1) The SMS shall support a Cardholder Use Limit feature that shall allow system administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.
- l. Extended Individual Strike Times:
 - 1) The SMS shall support Extended Individual Strike Times that allows a card reader's strike to be active for an extended period of time beyond the pre-determined standard strike time on a per cardholder basis. The extended strike time shall be user definable up to 255 seconds. Extended strike times shall be set on a card reader by card reader basis.
- m. Extended Individual Door Held Open Times:
 - 1) The SMS shall support Extended Individual Door Held Open Times that allow a card reader's door to be held open for an extended period of time beyond the pre-determined standard held open time on a per cardholder basis. The extended held open time shall be user definable up to eight (8) hours. Extended held open times shall be set on a card reader by card reader basis.
- n. Extended, On Demand, Door Held Open Times:
 - 1) The SMS shall support Extended, On Demand, Door Held Times via a command keypad located in the field. The Extended Held Open command configuration shall consist of a command key sequence that shall be from three to six keys used to enter the number of minutes to extend the door held open time (up to 999 minutes) and a pre-alarm time (from 0 to 30 minutes).
 - 2) Only those cardholders having command authority at a given card reader configured for 'Allow User Commands' shall have the ability to execute the Extended Held Open command at that card reader. The Extended Held Open command shall be available after a valid cardholder has received an access grant at the card reader. The cardholder shall have a period of 15 seconds after the access grant to enter the extended held open command sequence.

- o. Guard Tour:
 - 1) The SMS shall support Guard Tour functionality. A tour shall consist of one or more checkpoints defined as card readers or alarm inputs that a guard shall check during a guard tour.
 - 2) Each tour shall be assigned a name of up to 128 characters and subsequently assigned to one or more alarm monitoring workstations that indicate from where automatic tours are to be launched.
 - 3) Each tour shall consist of a series of checkpoints that shall include card readers and/or alarm inputs. Tour checkpoints shall be ordered in the sequence within which they are to be visited. Tour checkpoints shall be assigned minimum and maximum times within which to be reached. A "Tour Beginning" checkpoint shall also be defined to be linked with output actions. Checkpoints shall be able to be placed onto a graphical map.
 - 4) A tour shall be able to be linked to live video. Instructional text shall be assigned to a tour. These instructions shall be able to be viewed and printed prior to launching the tour from an alarm monitoring workstation.
 - 5) Tours shall have the option of being scheduled.
 - 6) The SMS shall support random tours.
- p. Tour Groups:
 - 1) The SMS shall support tour groups. Tour groups will consist of one or more tours, listed by alphanumeric names.
- q. Guard Tour Live Tracking:
 - 1) The Guard Tour Live Tracking window shall be opened automatically at the initiating monitoring station whenever a tour is launched. The Guard Tour Live Tracking window shall consist of a series of columns including:
 - a) Checkpoint sequence number
 - b) Checkpoint name
 - c) Checkpoint status
 - d) Checkpoint minimum time
 - e) Checkpoint maximum time
 - f) Checkpoint time
 - 2) The following checkpoint statuses shall be supported:
 - a) Checkpoint Not Reached
 - b) Checkpoint Reached On Time
 - c) Checkpoint Reached Early
 - d) Checkpoint Overdue
 - e) Checkpoint Reached Late
 - f) Checkpoint Out of Sequence
 - g) Checkpoint Missed
 - h) Guard Tour Initiated
 - i) Guard Tour Completed

- j) Guard Tour Completed With Errors
 - k) Guard Tour Cancelled
 - l) Guard Tour Terminated
- r. Guard Tour Live Video:
 - 1) Multiple live camera views shall be able to be displayed simultaneously in a “sliding window” format. The next checkpoint to be hit shall be able to be highlighted within the surveillance system.
- s. Graphical System Overview Tree:
 - 1) A Graphical System Overview Tree shall display a graphical representation of all field hardware including hardware from other systems which are interfaced, System administrators shall be able to modify a device that is depicted on the Graphical System Overview Tree or see its properties by double clicking on the icon, and the SMS shall bring them to the appropriate form.
- t. Pre-Alarm:
 - 1) The SMS shall support a Pre-Alarm feature at the card reader. The pre-alarm will sound a tone at the card reader prior to the door held open alarm. The pre-alarm setting shall be configurable for up the maximum allowable door hold open time.
- u. Alarm/Event Logging:
 - 1) All alarms and events in the SMS shall, by default, always be recorded in the database. The SMS shall give system administrators the ability to select, on a time-zone basis, the times that they require the SMS to log specific events to the database.
 - 2) System administrators shall have the option for particular alarm/events to be set to log or not to log on any individual reader and/or input.
- v. Scheduling Utility:
 - 1) The SMS shall provide an integral Scheduling Utility. The Scheduling Utility shall allow system administrators to schedule actions to occur on a one-time or a recurring basis. Recurring schedules shall be configured to begin immediately, last indefinitely, or have optional start and end dates.
 - 2) The Scheduling Utility shall be available from both the system administration and alarm monitoring modules.
 - 3) The types of actions that shall be schedulable include, but are not limited to:
 - a) Action Group
 - b) Event Archiving/Purging
 - c) Arm/Disarm Area
 - d) Start of Guard Tour
 - e) Execution of Scripts
 - f) Activate, Deactivate, Pulse Device Output and Device Output Groups
 - g) Global Anti-Pass back Reset
 - h) Download Firmware to equipment.

- i) Download Database to ISCs
 - j) Execute Function List
 - k) Mask/Unmask Inputs, Input Groups, Alarm Mask Groups, Door Forced Open or Held Open
 - l) Open Door, Open Door Group
 - m) Change Reader Mode
 - n) Automatic Reports
 - o) Reset Use Limit
 - p) Move Bulk Credentials from an Area
 - q) Deactivate Credentials
 - r) Logout Visitors
 - s) Schedule PTZ Presets
- 4) The Scheduling Utility shall maintain a history log in the database for actions that it executes.
- 18. Multiple Card Formats:
 - a. Each ISC shall support a minimum of eight (8) access control card formats and, if applicable, eight (8) asset formats.
- 19. Card Reader Cipher Mode:
 - a. The SMS shall support a Card Reader Cipher Mode that shall allow authorized cardholders to enter their credential ID by typing it into a card reader keypad, thus emulating the presentation of the credential to the card reader.
- 20. Denied Access Attempts Counter:
 - a. The SMS shall support a Denied Access Attempts Count on a per card reader basis. The "Denied Attempts Count" value shall be configurable from 0 to 255. The following access denial types shall cause the current denied count to be incremented:
 - 1) Unknown PIN entry at a card reader configured as 'PIN or Card' mode.
 - 2) Invalid cipher entry at a card reader in Cipher Mode.
 - 3) Invalid PIN entered for a given card at a card reader configured as 'Card and PIN' mode.
 - 4) Non-matching biometric presented for a given card at a card reader in Biometric Verify mode.
- 21. Card Reader Time Zone Overrides:
 - a. The SMS shall allow for the pre-defined default card reader settings to be overridden or temporarily changed on a time-zone basis. At the beginning of the selected time zone, the selected card reader's operational mode shall be modified from its default mode to any one of the following modes: Locked, Unlocked, Facility Code, Card Only, Card or PIN, Card and PIN, Card and Biometric, Card or PIN and Biometric, and/or Card and PIN and Biometric. The aforementioned options shall be available depending on the type of card reader used.
 - b. Each card reader shall have the ability to have multiple time zone setting overrides assigned to them as required by the system administrator.

22. Alarm/Event Routing:
- a. The SMS shall be capable of allowing system administrators to route alarms and events to various alarm monitoring client workstations on the network. The SMS shall allow any alarm or event to be routed to one or multiple client workstations on the network regardless of where the alarm is generated in the field. Alarms shall be routed to client workstations on a device-by-device level.
 - b. The SMS shall be capable of automatic re-routing of an alarm from workstation X to workstation Y if the alarm is not responded to within a user definable time period.
 - c. The SMS shall implement network synchronization such that in the event that an alarm is routed to multiple client workstations, once the first client workstation acknowledges the alarm, the alarm shall be cleared from all other client workstations. As such, alarms that are routed to an Alarm Monitoring client workstation that does not have a System Operator logged in shall be queued so that all unacknowledged alarms will report to that client workstation once a System Operator has logged into the SMS. Alarms/Events shall be routed based on default settings or time zone control.
23. Text Instructions:
- a. The SMS shall allow for a set of text instructions to be associated with each alarm that arrives into the SMS. The text instruction function shall allow the system administrator to enter a minimum of 32,000 characters of text for procedures to follow for each alarm that arrives at the alarm monitoring client workstations. Each alarm or event in the SMS shall have its own unique set of text instructions.
24. Customizable Voice Instructions:
- a. The SMS shall allow for a customizable voice instruction to be associated with SMS alarms. The customizable voice instruction feature shall allow the system administrator to record a voice instruction of unlimited length.
25. Alarm Attributes:
- a. The system administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis. Each alarm and/or event shall have the option(s) to:
 - 1) Display at one or more alarm monitoring client workstation.
 - 2) Allow higher priority alarms to be displayed on the alarm monitoring client workstation ahead of lower priority alarms.
 - 3) Require the field device that generated the alarm to be restored to its normal state before the alarm is cleared.
 - 4) Print the alarm to the local event printer.
 - 5) Have a customized voice message annunciate at the client workstation.
 - 6) Have the alarm breakthrough to the alarm monitoring window should the system operator be working in another application
 - 7) Allow system operators to change the journal entry once the alarm has been acknowledged.
 - 8) Ensure that the alarm will not be able to be deleted from the alarm monitoring window upon acknowledgment.

- 9) Display text and audio instructions outlining the procedures to follow when responding to the alarm.
- 10) Automatically call-up associated maps.
- 11) Automatically call up the associated cardholder record.
- 12) Automatically call up the associated cardholder photo using the video verification function.
- 13) Require a password to view the alarm.
- 14) Require a password to acknowledge the alarm.
- 15) Require acknowledgment to clear.
- 16) Allow mandatory journal entry upon acknowledgment.
- 17) Use pre-defined journal entries for alarms.
- 18) Select the option for journal entry based upon the specific alarm.
- 19) Send surveillance interface commands to the surveillance system.
- 20) Automatically send an e-mail message.
- 21) Automatically send an alphanumeric page.
- 22) Have the alarm appear on the alarm monitoring window with a flashing colored coded bar across the alarm for high priority alarms.
- 23) Have the alarm, when acknowledged, display an alternative flashing color coded bar across the alarm than for the original alarm color.
- 24) Trigger a function list(s) when the alarm is acknowledged.
- 25) Require user logon for acknowledgment.
- 26) Have the ability to mark an alarm as "In Progress" where the system shall silence any repeating audio notifications on the workstation where the alarm was routed and remove the alarm sprite notification on the graphical map. Additional operators' monitoring alarms shall be notified that the alarm has been marked "In Progress".

26. Alarm-Event Mappings:

- a. The SMS attributes in Alarm Attributes shall be assignable on a 'global' basis to all devices that share an alarm description. Thus, the 'Door Forced Open' alarm attributes shall apply to any door with a card reader that is forced open in the SMS. The SMS shall have the capability to assign a unique group of alarm attributes to specific device/alarm combinations to override the global settings for specific case settings. Each device/alarm combination shall have the ability to have its own unique attribute set if the system administrator desires.

27. System Downloads:

- a. The SMS shall provide for the downloading of data to the ISCs. Downloads shall load SMS information such as time zones, access levels, alarm configurations, cardholder information and card reader configurations.
- b. All ISCs on the SMS shall be capable of either full or selective downloads to individual intelligent system controllers, and bi-directionally so that alarms will still report to their respective alarm monitoring client workstations as cardholder information is being downloaded.

- c. Information on cardholder status, credential status, time zones or access levels shall download in real time as they are added, modified, or deleted from the SMS.
- 28. Portal Configuration Options:
 - a. The SMS shall include the following options for each portal on the system:
 - 1) Allow user commands such as manual door unlock
 - 2) Rename auxiliary inputs
 - 3) Rename auxiliary outputs
 - 4) Independently supervise REX and DPS
 - 5) Configure REX and DPS as Normally Open or Normally Closed
 - 6) Deny if duress
 - 7) Assume door used
 - 8) Alarm masking
 - 9) Activate outputs
 - 10) Two card control
 - 11) Checkpoint
 - 12) Do not activate strike on REX
 - 13) The ability to allow system administrators to determine on a time-zone basis to log or not to log on a card reader by card reader basis
 - 14) Access grants
 - 15) Access denied
 - 16) Card reader status alarms
 - 17) The SMS shall allow for user definable door strike functionality for each card reader in the SMS
 - 18) The SMS shall allow for each card reader to be selected as either an 'In' reader, 'Out' reader, or 'None' to allow for ease of reporting time and attendance basic 'Time In' and 'Time Out' data.
 - 19) Enforce Use Limit: This option shall enable card use limits at the card reader. limiting the number of times that cardholders may use their credential to gain access at the card reader
 - 20) Supervise Door: Sets the SMS so that the card reader door contact is wired as a supervised input
- 29. The SMS shall allow for one or more access points in a specified area to be armed and disarmed directly from a control keypad.
- 30. Real-Time, Live Video User Verification:
 - a. The SMS shall have the capability of interfacing to a surveillance system and displaying a live video image next to a stored cardholder image record. This feature shall be system configurable.
- 31. Traces:
 - a. The SMS shall allow for a live or historical trace on any ISC, ICM, alarm input, credential (cardholder), intrusion detection device, monitor zone, or card reader. If applicable, the SMS shall allow for a trace on any asset, intercom, or camera. Multiple traces may be run simultaneously. The SMS shall allow system operators to filter alarm types from the history trace

window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms.

- b. Destination Assurance: The system shall provide the ability to alert the system operator when a cardholder does not reach a required location and present their credential after entering at a designated checkpoint in a designated period of time.

32. Real-Time, Dynamic Graphical Maps:

- a. The SMS shall support graphical maps that display device and group status, function lists and video cameras dynamically in real time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and/or color to reflect the current state of the device.
- b. The SMS shall support all map formats listed below:
 - 1) Adobe Photoshop (.psd)
 - 2) AutoCAD DXF (.dxf)
 - 3) Encapsulated Post Script (.eps)
 - 4) JPEG (.jpg)
 - 5) TIFF (.tif)
 - 6) Windows Metafile (.wmf, .emf)
 - 7) Windows Bitmap (.bmp, .dib)
- c. The SMS shall support map hierarchies or maps within maps. There shall be no limit to the number of maps that shall be nested hierarchically with each other. Multiple maps may be displayed simultaneously.
- d. The SMS shall support user defined icons for field hardware devices. The SMS shall also give system operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask/unmask alarm inputs, and activate/deactivate/pulse an output from the map icons.
- e. The graphical maps shall have the ability to be printed to a local printer.

2.6 ACCESS CONTROL GRAPHICAL USER INTERFACE (GUI)

- A. A workstation based custom GUI shall be provided for complete display of real time system activity.
- B. The GUI shall provide the following features:
 - 1. Display in real-time, the status of devices by dynamically changing shape or color to indicate status.
 - 2. Acknowledge alarm conditions.
 - 3. Perform manual operations on all monitor and control points.
 - 4. Perform graphic editing functions.
 - 5. Customization of icons color or shape based on status.
- C. Graphical representations shall be made of the following activity:
 - 1. Cardholder Activity: Access granted (including duress), access denied, lost card used, stolen card used, inactive card used, unescorted visitor.
 - 2. Input Point Activity: Input condition (normal, abnormal, cut, short, shunt, unshunt).
 - 3. Output Point Activity: On status (automatic, by operator, by link), off status (automatic, by operator, by link), access level on, access level off.

4. Door Activity: Auto unlock, auto lock, closed, opened, forced open, left open, door switch cut, door switch shorted, REX status (cut, shorted, normal, abnormal), input unlock, operator lock, operator unlock.
 5. Controller Activity: Controller on-line, controller off-line, controller communications normal, communications cut.
 6. System Activity: System error, workstation start, workstation stop, printer off-line, printer unavailable, printer overflow, unknown card.
 7. Regional Group Activity: Occupancy restriction (high limit, low limit), anti-pass back (entry, exit), policy violation, escort left, number of escorts, numbers of users, number of visitors.
- D. The GUI shall have the ability to display a minimum of 100 custom graphical screens, developed by the SMS vendor with electronic maps provided by Owner.
 - E. The system shall have the ability to automatically call up specific maps. Each input point shall be linked to a primary map.
 - F. Graphical editing software shall be included, allowing the Owner to create and edit the graphical screens.
 - G. Graphics screens shall be developed using a minimum of eight (8) colors from a palette of 64 available.
 - H. The system shall operate on a Windows workstation as provided and recommended by the SMS vendor.

2.7 CREDENTIALS AND BADGING

- A. Badging Station:
 1. Provisioning:
 - a. The workstation(s) shall be furnished by the Contractor and shall meet the specifications defined by the SMS software manufacturer to meet or exceed the functionality and performance specifications of the system and integrations defined in this and related sections. Contractor shall coordinate with Owner for possible requirements to utilize a specific manufacturer. Contractor-furnished workstation(s) shall have a three (3) year limited warranty.
 - b. Provide (1) workstation total for SMS administration, badging and video surveillance functions.
 2. Software:
 - a. General:
 - 1) The SMS shall support a credential design module that is integral to the SMS source code with the ability to create and maintain credential designs. Features shall include the ability to support:
 - a) Complete credential design and layout tools
 - b) Chroma key
 - c) Image import
 - d) Ghosting
 - e) Signature capture
 - f) Barcodes
 - g) Smart chip support

- b. Licensing
 - 1) Required badging/credential management licensing shall be furnished.
 - 3. Hardware:
 - a. Utilize same hardware as the SMS Workstation.
 - b. Printer:
 - 1) Printer Manufacturer shall be:
 - a) Fargo
 - b) Magicard
 - 2) The SMS shall support a printer with industry standard and Microsoft certified drivers. The printer shall support:
 - a) Double sided printing at a resolution of no less than 300 dpi, full color on the front, monochrome on the back
 - b) Edge to edge printing
 - c) High speed printing per card of a minimum of 7 seconds for monochrome and 35 seconds for YMCKO
 - d) Holographic overlay
 - e) Inline magnetic stripe encoding
 - f) Inline Contactless Smart card encoding
 - g) An input feeder/hopper with a minimum capacity of 100 cards and an output stacker/hopper with a minimum capacity of 30 cards
 - c. Images:
 - 1) Camera:
 - a) The badging station shall be compatible with flash lighting and USB connected cameras, allowing the capture of a cardholder image at a minimum resolution of 3 mega pixels.
 - b) SMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG (Joint Photographic Experts Group).
 - c) The SMS shall provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.
 - 2) Image Import:
 - a) The SMS shall allow system operators to have the ability to import a cardholder's image at the time of enrollment. The SMS shall support importing image formats of Bitmap (.bmp, .dib), JPEG (.jpg), JFIF (.jif), Adobe Photoshop (.psd), Macintosh PICT (.pct), Portable Network Graphics (.png), TIFF (.tif), Windows Metafile (.wmf, .emf).

4. Badge Design:
 - a. Provide training and work in conjunction with Owner for development of four (4) badge designs.
5. Supplies:
 - a. Print Ribbons:
 - 1) Ribbons shall be provided to print badges, plus one spare ribbon of the same type and capacity.
 - b. Cleaning Kits:
 - 1) One cleaning kit shall be provided for every ribbon provided.
 - c. Lanyards and Sleeves:
 - 1) Lanyards and badge sleeves shall be furnished by Owner.
 - d. Badge Quantities:
 - 1) Badge quantities and types shall be as defined below.
- B. Credentials:
 1. Multi-Technology Contactless Smart Cards: 13.56 MHz and 125 kHz proximity radio frequency identification electronics, passive design. Card shall meet ISO 15693 and ISO 14443B2 standards.
 - a. Maximum Dimensions: CR 79: 3.313" x 2.063" x 0.04", CR 80: 3.375" x 2.125" x 0.04".
 - b. Construction to be of PVC or polyester laminate with a high coercivity magnetic stripe rated 4000 Oersted.
 - c. Cards shall contain options for various memory capacities of 2k, 16k or 32k with a fixed number of application areas or areas which are sized by dynamic allocation.
 - d. Each application area shall contain a unique authentication key. The card and reader shall require matching keys in order to function together. All RF communication between card and reader shall be encrypted using a secure algorithm.
 - e. Cards shall be encoded with bit lengths that are compatible with all other components of the SMS.
 - f. Application areas shall be reserved for cashless vending applications or future applications as Owner requires.
 - g. Cards shall support programming and updating of custom applications after issue.
 - h. Cards shall be capable of having a photo and/or other graphical images printed directly on the surface of the card.
 - i. Provide optional slot punch-outs on the short and long edge of the card.
 - j. Provide 200 Contactless Smart cards multi-technology cards. Cards shall be individually numbered with sequential matching of internal and external numbers.
 - k. Cards shall be provided with a lifetime warranty.

C. Credential Management:

1. The SMS shall support a Credential Management and Enrollment module that is integral to the SMS source code with the ability to create and maintain the cardholder database. Features shall include the ability to:
 - a. Add, modify and delete records based upon permissions
 - b. Capture photo images, biometric information and signatures
 - c. Print credentials
 - d. Boolean search on any single or multiple fields
 - e. Customization of screen layout and field names
 - f. Advanced customization of fields, field names and screen tabs (pages) with optional Forms Designing and Editing module
 - g. Determine single or multiple active credentials
 - h. Assign access levels and access groups
 - i. Bulk assignment/modification/deletion of access levels
 - j. Bulk deletion of cardholder records.
 - k. Limit the number of times the credential can be printed
 - l. Limit the access for searching the database based upon user defined criteria
 - m. Mobile badging operations.
2. The SMS shall support the following bar codes:
 - a. Code 3 of 9 (3:1)
 - b. Code 93
 - c. UPCA
 - d. EAN 13
 - e. EAN 8
 - f. Code 128 A
 - g. Code 128 B
 - h. Code 128 C
 - i. Codabar
 - j. PostNET (Zip + 4 Postal)
 - k. Code 3 of 9 (2:1)
 - l. Interleaved 2 of 5 (2:1)
 - m. PDF-417 (2D)
 - n. Code 128 Auto
 - o. UCC-128
 - p. MSI Plessey
 - q. Extended Code 3 of 9
 - r. Extended Code 93
 - s. 2D Aztec

2.8 PORTAL DEVICES

A. Credential Readers:

1. Manufacturers:
 - a. HID Multiclass SE
 - b. Ingersoll Rand aptiQ Multi-Technology
 - c. Pre-approved equal
2. Multi-Technology:
 - a. Compatible with 125 kHz proximity, 13.56 MHz Contactless Smart card, MIFARE, DESFire EV1.
 - b. Backwards compatibility with legacy 13.56 MHz Contactless Smart cards and 125 kHz proximity access control formats, including 26, 32, 35, 37 bit as well as HID Corporate 1000 format.
3. Card readers manufactured specifically for non-access control applications shall not be acceptable.
4. Provide compatibility with most access control systems by providing card data outputs in Wiegand and Clock/Data.
5. Allow the firmware to be updated in the field without the need to remove the reader from the wall.
6. Secure mounting methods using tamper resistant screws.
7. An audio beeper that provides various tones to signify access granted, access denied, power up and diagnostics.
8. Tri-color LED or three (3) LEDs for visual notification of various conditions.
9. ISO1443A, 1443B and 15693 compliant.
10. The ability to transmit an alarm from an integrated tamper switch.
11. Support dual authentication of identity through the combined use of access badge and personal identification number (PIN) on an integrated 12 key keypad.
12. PBT polymer or UL94 polycarbonate.
13. Read Range:
 - a. Using 125 kHz cards or 13.56 MHz Contactless Smart cards, minimum operational read range shall not be less than one (1) inch after the readers have been installed in their permanent locations.
14. Operational voltage of 5-16 VDC, with operating temperature range of -31° F to 150° F and rated for outdoor use with a minimum rating of IP55.
15. Readers and credentials shall be compatible with each other and shall be from the same manufacturer.
16. Available in sizes to be mounted to a standard single gang box or to a mullion. Maximum sizes:
 - a. Single gang box mount, with or without keypad: 5.1" x 3.1" x 1.1"
 - b. Mullion mount: 6.0" x 1.9" x 0.9"
17. Lifetime warranty against defects in material and workmanship.

B. Request-To-Exit Motion Detector:

1. Manufacturers:
 - a. Bosch DS 160 Series
 - b. Pre-approved equal

2. Door monitor with sounder alert. Sounder alert shall have adjustable volume.
 3. Adjustable latch time.
 4. Selectable fail safe/fail secure.
 5. Activation LED.
 6. 12 or 24 VDC operation.
 7. Sequential logic input.
 8. Two (2) Form C contacts.
 9. Tamper switch.
 10. Field of view masking.
- C. Request-To-Exit Button:
1. Manufacturers:
 - a. Dynalock 6290 Series
 - b. Seco-Larm SD7213 Series
 - c. RCI 991 Series
 - d. Pre-approved equal
 2. 0-60 second adjustable pneumatic action.
 3. Contacts shall be one of the following:
 - a. DPDT
 - b. SPDT double break with isolated common
 - c. DPST
 - d. Normally closed SPST with normally open SPST
 4. One and one-half inches (1-1/2") to two inches (2") red mushroom button.
 5. Stainless steel or aluminum plate labeled "EXIT" or "PUSH TO EXIT".
 6. Available in mullion mount.
- D. Door Position Switch
1. Manufacturers:
 - a. GE
 - b. GRI
 - c. Honeywell
 - d. Pre-approved equal
 2. Interior or Perimeter Door:
 - a. One (1) inch or 0.75 (3/4) inch diameter, recessed
 - b. DPDT contacts
 - c. 0.75" to 1.25" (3/4" to 1-1/4") gap for wood door
 - d. Maximum 0.375" to 0.625" (3/8" to 5/8") gap for steel door
 - e. Basis of Design: UTC/GE/Sentrol 1076D
 3. Overhead Door:
 - a. Three (3) inch gap
 - b. SPDT contacts
 - c. 18" stainless steel armored cable

- d. Aluminum construction
 - e. Basis of Design: UTC/GE/Sentrol 2207AU
- 4. Steel Door:
 - a. A rare earth magnet shall be used.
- 5. Cage/Gate:
 - a. Maximum 1.5 (1-1/2) inch gap
 - b. DPDT contacts
 - c. Three feet (3') stainless steel armored cable
 - d. Aluminum construction
 - e. Basis of Design: UTC/GE/Sentrol 2507AD
- E. Duress Buttons:
 - 1. Manufacturers:
 - a. Honeywell (Hardwired) 269R, 270R
 - b. United Security Products (Hardwired) HUB Series
 - c. Inovonics (Wireless) EN4216/32 MR Series
 - d. Linear (Wireless) DXSR-1508
 - e. Honeywell (Wireless) 5800 Series
 - f. Pre-approved equal
 - 2. Multi technology:
 - a. Hardwired:
 - 1) DPDT contacts
 - 2) Silent operation
 - 3) Recessed activation button to prevent accidental activation.
 - 4) Screw terminal connections
 - 5) Key switch resettable
 - 6) Momentary contacts
- F. Cable:
 - 1. Composite cable is allowed, although sufficient conductors may not be available in composite cables for all portal configurations. Contractor shall be responsible for additional required cables beyond one composite cable to each portal to meet functional requirements of the system.
 - a. Reader: 22 AWG, 3 pair, stranded, overall shield. Shield shall be grounded at control panel end only.
 - b. Request to Exit Motion Detector: 22 AWG, 4 conductor, stranded.
 - c. Door Position Switch: 22 AWG, 2 conductor, stranded.
 - d. Request to Exit Button: 18 AWG, 4 conductor, stranded.
 - e. Lock: Minimum 18 AWG, 4 conductor, stranded.
 - 1) Lock may require heavier gauge cable depending on door hardware solution power requirements. Contractor shall coordinate with door hardware provider for higher current devices and shall adjust the gauge of the lock cable accordingly.
 - f. Auxiliary Devices: Refer to plans for requirements.

- G. Locks and Door Hardware:
1. Electric/electronic locks shall be furnished and installed by the door hardware provider.
 2. Access Control Contractor shall interface with and terminate cables to locks.
 3. Access Control Contractor shall coordinate with door hardware provider for specified sequences of operation at the various portals.
 4. Electrified cylindrical and electrified mortise locks shall have an integrated request-to-exit device.
 5. Electric strikes shall have an integrated latch bolt monitor, and the dead latch shall be seated properly so that the strike cannot be defeated by manipulation.
 6. Magnetic locks shall have a magnetic bond sensor.
 7. Refer to architectural specifications and/or the architectural door schedule.

2.9 INTERFACES AND INTEGRATIONS

- A. Video Surveillance Integration and Interface:
1. The SMS shall be required to integrate with the surveillance system if a single-manufacturer solution is not proposed.
 2. The SMS integration to the surveillance system shall be classified as a high-level interface. The supported surveillance system manufacturers shall be those listed in Section 28 23 00. Dry contact closure or other low-level interface methods are not acceptable. The SMS shall be capable of passing alarm information via a Serial RS232 interface with any surveillance system that utilizes ASCII commands, or by a TCP/IP protocol interface using APIs. The two systems may be from different or the same manufacturers.
 3. Command information sent through the high-level interface shall include input point, door event, terminal controller points, operator events and system events, with the associated surveillance system commands.
 4. The SMS vendor shall be responsible for providing the interface programming in a protocol that is understandable by the surveillance system.
 5. The SMS to surveillance system integration shall perform the following:
 - a. Display a live video image next to a stored cardholder image record upon presentation of an access badge to a reader.
 - b. Any alarm event in the SMS shall have the ability to be associated with a video clip in real time, with configurable pre- and post-event recording duration.
 - c. SMS alarm events shall be capable of triggering a defined video sequence of operation, such as camera movement to a preset position.
 - d. Video alarm acknowledgement, such as motion detection, and alarm reset shall be supported from the SMS.
 - e. In the SMS, display a tiled screen of operator-selected live images in a similar format as what is viewable via the video management system alone.
 - f. Ability to view recorded images based on operator selected date, time and duration through the SMS.
 - g. Linking of an access control event to a video clip so that clicking on an event begins playing of that clip.
 - h. Ability to click on a camera icon on the SMS map to display live video from that camera and to select recorded video from the same camera.

6. Should the integration fail or malfunction after installation, the systems shall be able to operate independently until the problem(s) is resolved.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.
- C. Network controllers shall be installed centralized in the nearest telecommunications room(s). Mount controllers to the structural walls in a location coordinated with other utilities. Coordinate exact location with Architect/Engineer prior to installation. Provide dedicated +120 VAC emergency power circuit to the controllers using #12 AWG wiring from the nearest emergency electrical power distribution panel board.
- D. Provide wiring and connection to all electrified locking hardware devices. Complete programming and testing of all electrified locking hardware devices.
- E. Install all credential readers in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all credential readers. Complete programming, adjustment, and testing of all credential readers.
- F. Provide wiring and connection to all hardware request-to-exit devices that are integral to electrified door hardware. Provide wiring and connection to all request-to-exit motion detectors. Complete programming and testing of all integrated request-to-exit devices. Where possible, avoid false activation by persons passing by but not exiting.
- G. Install all request-to-exit motion detectors in accordance with manufacturer's instructions directly above the door frame, centered on the door opening. Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.
- H. Install all request-to-exit pushbuttons in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all request-to-exit pushbuttons. Complete programming, adjustment and testing of all request-to-exit pushbuttons.
- I. Install all door alarm contacts in accordance with manufacturer's instructions either recessed in the door header or surface mounted as required. Provide wiring and connection to door alarm contact devices. Complete programming, adjustment and testing of all door alarm contacts.
- J. Install all duress switches in accordance with manufacturer's instructions, surface mounted under counter in locations shown on plans. Verify exact mounting location with Owner prior to cable rough-in or installation. For hard wired devices, provide wiring and connection to duress switch devices. For wireless duress switch devices, mount receivers in accessible locations. Complete programming, adjustment and testing of all duress switch devices. Wireless testing shall include signal reception when transmitter is in all sections of the area in which it will be used in normal operations.
- K. Install, wire, configure, adjust, program and test all access control system servers, workstations, badging workstations and other user interfaces.
- L. Install, wire, configure, adjust, program, and test all specified interfaces and integrations between access control and other systems. Contractor shall provide all cabling, wiring, terminations, components, devices, accessories, hardware, software and other material and accessories necessary to complete all specified interfaces and integrations and make them fully operational.

- M. All low voltage access control cabling shall be routed with other low voltage cabling and shall route through cable tray and non-continuous cable support pathways to the fullest extent possible.
- N. Electronic access control system cabling shall not be spliced.
- O. Flexible conduit is not allowed except with prior approval. Refer to Section 26 05 33 for conduit requirements. Refer to Section 27 05 28 for cable hanger and support requirements.
- P. Each cable shall be appropriately identified, as defined on the record documents, at each end's termination point using pressure sensitive label strips.
- Q. The conductor color code used in terminating system cabling at system devices shall remain consistent from device to device for each unique device type throughout the project.
- R. Install and tighten all connectors in accordance with manufacturer's instructions using the appropriately designed tools recommended by the manufacturer for that purpose. Do not strip or damage connectors, terminals, or equipment by over tightening termination fasteners.
- S. Grounding and Bonding Requirements:
 - 1. Provide a minimum of 6AWG bonding conductor from each electronic access control system control panel, power supply and surge suppression device to the nearest telecommunications grounding busbar. Actual bonding conductor size is determined by its length; refer to Section 27 05 26 for grounding and bonding conductor sizing criteria.
 - 2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the control panel end.
- T. Coordinate installation of all devices with other trades and utilities in the vicinity.
- U. Cabling shall be plenum rated when installed outside conduit in plenum ceilings.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL) as suitable for purpose specified and indicated.

3.3 MANUFACTURER AND INTEGRATOR COMBINED FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor.
- B. The Contractor shall provide a comprehensive, site-specific customer planning guide for the system. The Contractor shall conduct conference(s) with the Owner prior to any installation to discuss the programming and configuration options of the system and the planning guide.
- C. The Contractor shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point and each operator and administrator. Any software programmable access policy, within the bounds of the hardware specified, shall be included.

- D. It shall be the responsibility of the Contractor to provide a complete, functional system as described by the design documents. These responsibilities include:
 - 1. Complete hardware setup, installation, wiring and software configuration of the system server, all workstations and all peripheral hardware.
 - 2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference(s).
 - 3. Manual data entry of 50 cardholders based on a printed roster provided by the Owner.
 - 4. Configuration of the network software for operation of the system. Templates shall be established representative of all user access right levels.
 - 5. Programming of all custom graphic GUI screens including devices.
 - 6. Complete system diagnostic verification.
- E. The SMS Installation Contractor shall be present at meetings to coordinate all door hardware requirements with the door hardware vendor.

3.4 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system
 - 2. Complete documentation of programming and access policies
 - 3. Complete operating instructions for all hardware and software
- B. The following sections shall be provided in the system documentation:
 - 1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
 - 2. User Manual: A step-by-step guide and instructions detailing all system user functions.
 - 3. Alarm Monitoring Manual: A step-by-step guide and instructions detailing all alarm monitoring system functions and responsibilities.
 - 4. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
 - 5. Refer to Part 1 for details.

3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Coordinate training days and times with Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. System Administrators: A course detailing the system functions, configurations and operations. Provide training on all aspects of the system including data import/export, report, cardholder management, system workstation and server configuration and maintenance, software and hardware configuration and peripheral hardware operation.

2. Operators: A course detailing the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control, operation of integrated systems interface, and general overview of the report hardware.
 3. GUI Editing: Conduct detailed training on using the GUI editing software. Topics shall include the editing of existing graphical maps and the creation of new graphical maps.
- E. Minimum on-site training times shall be:
1. System Administrators: Eight (4) hours
 2. Operators: Eight (4) hours.
 3. GUI Editing: Eight (2) hours.
 4. Integrations: Eight (4) hours
 5. Badging System: Eight (4) hours.
 6. Four (4) additional hours of training each quarter for the 12-month period of the project warranty shall be provided. A minimum of half of this additional training shall be on site; the remainder may be support by telephone or email. Contractor shall document this training, including dates performed, trainer and Owner representative(s) present. Each phone call or email shall be documented as a minimum of 15 minutes duration.
 7. Operators and administrators are present 24 hours a day, 7 days a week. Contractor shall coordinate with Owner to provide training for all appropriate personnel, which may require Contractor to be present on site during non-business hours. Therefore, the hours in any or all categories defined above may be divided among the various shifts.

3.6 SYSTEM ACCEPTANCE

- A. The SMS vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components, software and functionality. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's systems engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.
- C. The system shall not be accepted until all requirements of system documentation and training have been completed.

END OF SECTION

SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Network Video Management System (NVMS)
- B. Video Storage Solution
- C. Cameras and Accessories
- D. Cabling

1.2 RELATED WORK

- A. Section 26 05 33 - Conduit and Boxes
- B. Section 26 05 13 - Wire and Cable
- C. Section 27 15 00 - Horizontal Cabling Requirements
- D. Section 28 05 00 - Basic Electronic Safety and Security System Requirements
- E. Section 28 31 00 - Fire Detection and Alarm Systems
- F. Section 28 13 00 - Electronic Access Control

1.3 QUALITY ASSURANCE

- A. NVMS Software Developer (Manufacturer): The NVMS system shall be a single-source manufacturer such that the single manufacturer develops, supports, and warrants the NVMS software solution. The manufacturer shall have three (3) years documented experience.
 - 1. The software developer shall be, at a minimum, a Microsoft Gold Certified Integrator and Partner for systems that reside in a Microsoft environment.
 - 2. The software developer shall be an active ONVIF member with current available product recognized by ONVIF as a Conformant Product.
- B. Integrator/Installer (Contractor): The Contractor must be a NVMS-certified installation, service, and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.
 - 1. The integrator must have local service representatives within 120 miles of the project site.

1.4 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. Electronic Industries Association (EIA) Video Surveillance Equipment Standards
- C. UL 2044 - Standard for Commercial Closed Circuit Television Equipment
- D. UL 3044 - Standard for Safety for Surveillance Closed Circuit Television Equipment

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 28 05 00.
- B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
 - 1. Compliance with each requirement of these documents.
 - 2. All component options and accessories specific to this project.
 - 3. Electrical power consumption rating and voltage.
 - 4. Heat generation for all power consuming devices.

5. All required wiring shall be identified.
6. Number of IP addresses that will be required from the Owner's Information Systems Department.
7. Statement of Acceptability of Designed Server:
 - a. If the Contractor agrees that the server(s) designed and described herein is acceptable for the chosen manufacturer's solution and meets the demand of the application, this shall be stated in writing and submitted as part of the shop drawing submittal.
 - b. If the Contractor does not agree that the server(s) designed and described herein is acceptable for the chosen manufacturer's solution, Contractor shall itemize the quantity, technical specifications, and capacities of the servers required to support the functionality and device quantities required by the project drawings. Indicate the capacity utilization factor for each server.
 - c. Contractor's bid shall include any required changes in server(s) capacity.
8. Calculation for storage required using the criteria contained in the project drawings.
9. Calculation for required network bandwidth, including any latency restrictions.
10. Provide annual cost and all terms and conditions for the NVMS Software Maintenance Agreement. Include all additional costs and terms and conditions for any Annual Service Contracts provided by the Contractor for all services that are not included in the Software Maintenance Agreement.
- C. System Drawings: Project-specific system CAD drawings shall be provided as follows:
 1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical cameras), the diagram may show one device and refer to the others as "typical" of the device shown.
- D. Sample format of site-specific programming guides to be used for system planning/programming conference with Owner.
- E. Meeting agenda for planning/programming conference required in Part 3 of this specification.
- F. Submit detailed description of Owner training to be conducted at project end, including specific training time.
- G. Quality Assurance:
 1. Provide materials documenting experience requirements of the manufacturer and installing contractor.
 2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.
- H. Coordination Drawings:
 1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 28 05 00 for coordination drawing requirements.

1.6 SYSTEM DESCRIPTION

- A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey, closed circuit television system.
- B. Performance Statement: This specification section and the accompanying project drawings are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that

must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

- C. Refer to the project drawings for model numbers for the Basis of Design for all equipment.

1.7 LICENSING REQUIREMENTS

- A. All licenses required for system operation shall be included in the Contractor's bid. Licenses shall include, but not be limited to, server and workstation software, cameras, encoders/decoders, and any other licensing that is required by the manufacturer for operation of any system component.
 - 1. Camera licenses shall be provided for all cameras listed on the Camera Schedule whether cameras are new or existing.
 - 2. The system shall be provided with installed software capacity to accommodate a minimum quantity of 24 cameras. The licensing for all 24 cameras shall **NOT** be included in the Contractor's bid. Licensing shall only be included for the quantity of cameras shown on the Camera Schedule. However, the system's ability to support up to a total capacity of 24 cameras shall **ONLY** require future payment of additional per-unit camera licensing fees by the Owner. In no case shall the Owner be required to upgrade the software provided in the Contractor's bid to achieve support for a total of 24 cameras, including the payment of any software upgrade fees, installing a different software version, etc.
 - 3. If the manufacturer requires the purchase of a block of licenses (instead of selling a single license for a single device) the Contractor's bid shall include the appropriate block of licenses that accommodates all device quantities described by the project drawings, plus 6 additional devices for future growth.
 - 4. Camera licensing that is restricted to a particular device MAC address or in any way is only valid for a particular manufacturer or model number is not acceptable. Camera licenses shall be issued such that the Owner can replace a camera with another camera brand and/or model number and transfer the license from the old camera to the new camera at no additional cost at any future time. This license transfer procedure shall be capable of being performed by the Owner and shall not require the services of an integrator.
 - a. Exception: When a camera license is issued as a no-cost license in the limited condition that the NVMS manufacturer and the camera manufacturer are the same company, it is permissible to charge a future license fee to the Owner if the Owner elects to replace the NVMS manufacturer-branded camera with a third-party manufacturer's camera.
 - 5. The Contractor shall fill out the NVMS Bid Inventory Form located herein and provide at the time of bid.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 28 05 00.
- B. Provide final system block diagram showing any deviations from shop drawing submittal.
- C. Provide statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.
- D. Provide final camera type and camera requirements schedules documenting all changes made during construction.
- E. Warranty: Submit written warranty and complete all Owner registration forms.
- F. Complete all operation and maintenance manuals as described below.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit documents under the provisions of Section 28 05 00.
- B. Manuals: Final copies of the manuals shall be delivered within 14 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the manufacturer for each piece of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:
 - 1. Hardware Manual: The manual shall describe all equipment furnished including:
 - a. General description and specifications.
 - b. Installation and check out procedures.
 - c. System layout drawings and schematics.
 - d. Alignment and calibration procedures.
 - 2. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper installation, testing, and operation. The manual shall include:
 - a. Definition of terms and functions.
 - b. System use and application software.
 - c. Graphical user interface use.
 - d. Reports generation.
 - 3. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - a. Computers and peripherals.
 - b. System startup and shutdown procedures.
 - c. Use of system.
 - d. Recovery and restart procedures.
 - e. Use of report generator and generation of reports.
 - f. Data entry.
 - g. Operator commands.
 - h. Alarm messages.
 - i. System permissions functions and requirements.
 - 4. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.10 WARRANTY

- A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.
- B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.
 - 1. Inspections: Perform one minor inspection six-months after Substantial Completion and one major inspection prior to the expiration of the warranty.

2. Minor Inspections: Inspections shall include:
 - a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
 - b. Mechanical adjustments if required on any mechanical or electromechanical devices.
 - c. Install all available software updates, patches, or bug fixes available from the NVMS manufacturer.
3. Major Inspections: Inspections shall include all work described under paragraph Minor Inspections and the following work:
 - a. Clean all equipment, including interior and exterior surfaces.
 - b. Perform diagnostics on all equipment, including all system software diagnostics, and correct all diagnosed problems.
 - c. Adjust all camera alignments that have become out of alignment from their documented position at Substantial Completion.
 - d. Install all available software updates, patches, or bug fixes available from the NVMS manufacturer.
 - e. All warrantable system deficiencies during the Major Inspection shall be remedied under warranty at no cost to the Owner.
- C. Operation: Upon the performance of any scheduled adjustments or repairs, verify operation of the NVMS system.
- D. Emergency Service: The Owner will initiate service calls when the NVMS system is not functioning properly. Qualified personnel shall be available to provide service within the distance defined above. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365.
- E. Records and Logs: Keep records and logs of each task completed under warranty. The log shall contain all initial settings upon Substantial Completion. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the NVMS system.
- F. Work Requests: Record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what must be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Deliver a record of the work performed within five (5) days after work is accomplished.
- G. System Modifications: Make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected. To the fullest extent possible, the Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.
- H. Software: Provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with NVMS system operators, shall include training for the new changes/features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.
- I. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - PRODUCTS

2.1 NETWORK VIDEO MANAGEMENT SYSTEM – GENERAL REQUIREMENTS

- A. The network video management system (NVMS) shall be an enterprise-class client/server based video security solution that provides management of digital video, audio and data across a TCP/IP network. This server should be the same hardware as the SMS server, refer to 28 13 00.
- B. Provide a turnkey solution that includes furnishing, installation, and configuration of a separate IP network, complete with all required network electronics, switches, and other hardware. The VMS shall utilize network switch ports provided by the Owner for all required IP connections. Provide the Owner with a complete list of all IP ports required.
- C. ONVIF Compliance
 - 1. The NVMS system shall be ONVIF certified as an ONVIF Network Video Client.
 - 2. Cameras shall be ONVIF certified as an ONVIF Network Transmitter unless specifically noted as an exception to this requirement in the project drawings.
- D. The NVMS system shall be an “open system.”
 - 1. To meet this requirement, the NVMS must directly support cameras from a minimum of three (3) readily available camera manufacturers.
 - 2. The three (3) camera manufacturers must have no corporate relationship to the NVMS manufacturer.
 - 3. “Directly support” shall be defined as plug-n-play using drivers that are commercially available at the time of bid that utilize the ONVIF specification as the means of integration]
 - 4. In addition to the requirement to support three (3) independent manufacturer’s cameras, the NVMS may support an unlimited additional quantity of in-house or other proprietary cameras.
 - 5. The open system shall not require proprietary storage solutions. It shall support third party storage solutions, including:
 - a. Commercially available Direct Attached Storage (DAS) devices.
 - b. Network Attached Storage (NAS) devices.
 - c. Storage Area Networks (SAN) for **primary** or archival storage purposes. Primary support for SAN shall be defined as:
 - 1) The ability to directly record to SAN device without first recording to an NAS or DAS.
 - 2) The NVMS is provided with a user experience that makes the video recorded to the SAN transparent to the user. This shall be defined as:
 - a) Full search, bookmarking, and other software features for finding, marking, locating, and identifying video are supported by the NVMS for video recorded to a SAN in an identical way to video that is recorded to an NAS or DAS.
 - b) No loading of the video from the SAN into the NVMS shall be required.
 - c) Full playback, windowing of camera video, archiving, and exporting is supported by the NVMS for video recorded to the SAN in an identical way as video recorded to an NAS or DAS.

6. The system must have a published API/SDK permitting third party integrations to the product without restrictions.
7. The NVMS shall support active directory using LDAP protocol.
- E. The NVMS system shall consist of the following hardware/software components:
 1. Software:
 - a. Server and client
 - b. Recording services, archival services, and storage management
 - c. Configuration tools
 2. System storage as specified on the project drawings.
 3. Cameras and related hardware as specified on the project drawings.
 4. Hardware: Servers, workstations, and miscellaneous hardware (keyboard, mouse, KVM) as specified on the projects drawings.
 5. Network electronics and related hardware and software as specified on the project drawings.
- F. Video from any camera on the system (on the LAN, WAN or Internet) shall be capable of being viewed from single or multiple workstations simultaneously at any time, limited only by network bandwidth.
- G. The NVMS shall support simultaneous displaying of live (30 fps) video of a minimum of 16 cameras while the video monitoring screen is configured in a 16-camera split configuration. In no case shall the frame rate of the camera be required to be restricted to less than 30 fps to display a 16-camera split view.
- H. Simultaneous display and recording of every camera shall be supported with independent user-adjustable frame rates that can be set differently for the display stream and the recording stream. These independent settings shall be unique per camera.
- I. The NVMS monitoring software shall support any combination of recorded and live video in any multiple camera split view, including viewing recorded video and live video from the same camera.
- J. The NVMS shall support continuous recording and event-based recording simultaneously. This shall be capable of being set on a per camera basis.
- K. Viewing of video (live and recorded) shall be possible from client software from any client hardware that is connected to the security LAN/WAN or Internet (through appropriate firewalls). In addition, system administration shall be permitted from remote client hardware.

2.2 NVMS MANUFACTURERS

- A. Basis of Design: Avigilon
- B. S2
- C. Lenel
- D. Genetec

2.3 NVMS SYSTEM DETAILED REQUIREMENTS

- A. Network Requirements: The NVMS shall support Ethernet 10/100 BaseT and Gigabit Ethernet.
 1. Network protocols shall be supported including TCP/IP, IPX, and UDP.
 2. The network interface shall allow remote access of the NVMS from anywhere on the end-user's LAN/WAN or Internet (behind firewall).
 3. The system shall permit limiting of frame rate transmission to individual clients.

4. Both Multicast and Unicast shall be supported.
 5. All transmission of system data shall be secured using Secure Socket Layer (SSL) security on the TCP/IP network.
 6. Simple Network Management Protocol (SNMP) shall be supported.
- B. Video Formats:
1. The NVMS shall support MPEG-4, and H.264 compression formats.
 2. The system shall support any single stream of bandwidth up to 90Mbit/sec at 30 fps at 4872 x 3248 resolution with no system performance degradation, assuming appropriate network bandwidth.
 3. Video shall be recorded using a 256-bit encryption algorithm with authentication (watermarking) software suitable for evidentiary proceedings. The watermarking feature shall provide evidence of altered video.
 - a. The video shall be watermarked with the authentication key/signature during recording of live video to the drive.
 - b. A video player shall be provided with the NVMS system.
 - 1) The player shall have the ability to validate the authentication upon playback.
 - 2) This authentication shall provide the storage media name, camera name, video time, and user information.
 - 3) The authentication shall have the ability to be password protected.
 4. Resolution:
 - a. The camera resolution shall be user selectable on a per-camera basis. Selecting or changing resolution shall not require a restart of the application, server, or workstation.
 - b. The system shall support the following resolutions:
 - 1) NTSC Resolutions: 0CIF (176 x 120), CIF (352 x 240), 2CIF (704 x 240), 4CIF (704 x 480).
 - 2) VGA Resolutions: QVGA (320 x 240), VGA (640 x 480), SVGA (800 x 600), XVGA (1024 x 768), 4xVGA (1280 x 960).
 - 3) Megapixel Resolutions: SXGA (1280 x 1024: 1.3MP), SXGA + EXGA (1400 x 1050: 1.4 MP), UXGA (1600 x 1200: 1.9MP), WUXGA (1920 x 1200: 2.3MP), QXGA (2048 x 1536: 3.1MP), WQXGA (2560 x 1600: 4.1MP), QSXGA (2560 x 2048: 5.2MP), 3296 x 2472: 8MP, 4000 x 2672: 11MP, 4864 x 3248: 16MP, 6576 x 4384: 29MP.
 - a) 16:9 and 4:3 formats shall be supported.
 - 4) HDTV Resolutions: 720p, 1080(i/p) in 16:9 format.
- C. Remote Clients:
1. The NVMS system shall include the ability to view live video or playback recorded video over the LAN/WAN or the Internet from any PC. This function shall NOT require any installed client software. An industry standard Web Browser (e.g., Internet Explorer, Firefox, Chrome) shall be the only software required to view non-authenticated video from a remote PC.
 - a. Any plug-ins (e.g., ActiveX, Java, Flash) required to view remote video shall be capable of being pushed to the user's PC at the time of initiating the remote video viewing session.

- b. Remote viewing shall be supported whether the remote client is:
 - 1) Inside the firewall containing the NVMS.
 - 2) Outside the firewall containing the NVMS.
 - 3) Accessing the NVMS through a VPN.
 - 2. Remote Client Features:
 - a. Display live video.
 - b. Digital zooming and panning of fixed cameras.
 - c. PTZ camera control in real time, including adjusting PTZ lock and dwell times.
 - d. Ability to access video from all accessible recording devices.
 - e. Priority-based camera control takeover.
 - f. Customizable camera viewing screen split configurations that are retained under the user login between remote client sessions.
- D. Mobile Clients (Apps):
 - 1. The NVMS shall include a mobile video viewing application for the iOS/Apple and Android operating system.
 - a. The iOS application shall be a single universal application supporting both the iPhone 4s and iPad 2 resolutions. An iPhone application that scales up for use on the iPad using the iPad 1x/2x feature is not acceptable.
 - b. The Android application shall be a universal application that supports Android smartphones and Android tablets. The Android application shall support Android codeset name Ice Cream Sandwich and may require a minimum installed codeset of Gingerbread.
 - 2. Features:
 - a. The mobile client shall permit viewing of live video or playback of recorded video.
 - b. Split screen video display shall be supported. The split screen shall permit live and recorded video simultaneously in the screen split. The screen split layout shall be retained between mobile client sessions.
 - c. Provide time synchronization of the video of different cameras to account for mobile network latency to ensure that live video from multiple cameras is time synchronized.
 - d. The mobile client shall be optimized with video compression to support video viewing on mobile networks. The mobile client shall maintain a minimum of 7 fps per camera on a mobile network performing at 200 Kbit/s with a latency of 200ms.
 - e. All transmission of system data shall be secured using Secure Socket Layer (SSL) security at a minimum.
- E. Workstation Client Software Requirements:
 - 1. The client software for the NVMS shall run as an application on Windows 7 64-bit. The client software shall not require a PC more robust than that defined above in the section entitled "NVMS CLIENT REQUIREMENTS." Should the workstation client software require a PC configuration more robust than that defined herein, the cost of upgrading the workstation hardware to the more robust requirement shall be paid by the Contractor.
 - 2. This shall be the same hardware as the SMS workstation, refer to 28 13 00.

3. The client software shall provide video signal detection and provide alerts whenever video is lost on any input channel.
4. Updates to the client software shall be capable of being pushed to all clients from the NVMS server.
5. The client software shall provide a graphical mapping feature. The graphical map shall accommodate the importation of CAD files, or custom development of floor plans or site plans to create a to-scale or not-to-scale graphical representation of the system layout including all cameras.
 - a. Cameras located on the graphical map shall be “live,” which is defined as the ability to click the camera in the graphical user interface (GUI) to see camera information and live video. The camera name shall be available to the user via a “mouse hovering” maneuver over the camera icon.
 - b. For site cameras, the graphical map shall consist of an overall site plan showing all exterior cameras. Buildings and other physical entities on the site shall be graphically represented.
 - 1) The buildings shown on the site plan shall visually indicate to the user that cameras are located inside that building’s interior, if applicable.
 - c. The user shall be able to click a building that contains cameras to obtain a new graphical layout of that building. Once the building interior layout graphical map is on screen, interior cameras shall be represented by icons.
 - d. The user shall have the ability to navigate back to the main (previous) graphical map via a single-click graphical icon.
6. Camera Configuration:
 - a. Each camera shall be configurable for a 32-alphanumeric character name.
 - b. The system shall allow for the setup and adjustment of brightness, contrast, archiving, motion detection, and Pan/Tilt/Zoom on a per camera basis.
 - c. The NVMS shall support a separate frame rate for recording and a separate frame rate for viewing for every camera input (assuming the camera provides two streams). These frame rates shall be capable of being independently set for each camera input.
 - d. The NVMS shall support the PTZ control of analog NVMS cameras through the encoders.
 - e. The compression algorithm formats MJPEG and MPEG4 shall be supported in the same system and shall be individually selectable on a per-camera basis.
 - f. Each individual camera shall be capable of having individual camera settings that shall include (at a minimum):
 - 1) Continuous recording.
 - 2) Motion-based recording capability shall be provided including:
 - a) Motion as determined by the NVMS software using:
 - (1) Entire screen motion detection
 - (2) User defined area triggers
 - b) Motion as determined at the camera.

- c) Motion trigger by digital inputs from external trigger systems such as contact closures, alarm inputs, POS integration, etc.
 - (1) Motion triggers received by external trigger inputs shall be recorded by the event recording capabilities of the NVMS and identifiable on a timeline during playback and in reports.
 - 3) Alarm-initiated recording.
 - a) When a camera enters alarm recording mode, the NVMS shall have the capability of changing to different camera settings for the recorded video during the duration of the alarm mode. The settings capable of being changed shall include the frame rate and the resolution. These setting changes shall be configurable in advance per camera by the User through the software GUI.
 - 4) Time-based recording on a preset schedule.
 - 5) Manual (user) activation of the start and stop of the recording process through the GUI.
 - a) The NVMS software shall prevent any user from manually starting and stopping the recording of video based on that user's login credential.
 - 6) Defined pre-event and post-event recording buffers shall be provided for all non-continuous recording events.
 - 7) Each camera shall be capable of having unique storage retention settings.

F. Software Security Requirements:

- 1. All users shall be capable of being authenticated against Active Directory using LDAP, before being granted system access. Should the Owner not use Active Directory, the NVMS shall provide a built-in login and credential management tool to permit rules-based access rights on a per-user basis.
- 2. The access rights shall be selectable on a per-user basis. In addition, user groups shall be capable of being assigned whereby each user group has a common set of access rights. Users shall be capable of being assigned to these user groups by the system administrator.
- 3. Access rights available for customization shall include:
 - a. Live Video Viewing:
 - 1) Use of PTZ controls.
 - 2) Start and stop of manual recording.
 - 3) Access to and exclusive from individual cameras and monitors.
 - 4) Access to system settings.
 - 5) Ability to define video blocking positions of PTZ cameras for certain users.
 - b. Viewing Recorded Video:
 - 1) Ability to export recorded video. including email.
 - 2) Access to system archiving and backup.
 - 3) Ability to watch recorded video from individual cameras.
 - 4) Ability to delete recorded video.

- c. Camera Setup:
 - 1) Add or remove cameras from the system.
 - 2) Change camera settings including resolution and frame rate.
 - 3) Change motion detection and other defined triggers.
 - d. General Settings:
 - 1) Change client software settings.
 - 2) Ability for user to configure or change custom viewing screen configurations.
 - 3) Modify server settings.
 - 4) Change recording or bandwidth settings.
 - 5) Configure users.
 - 6) Access and configure external messaging capabilities.
 - 7) View, print, save and clear the system log.
- G. Pan/Tilt/Zoom (PTZ) Control:
 - 1. The NVMS shall support PTZ control from any client, including remote and mobile clients.
 - 2. The following PTZ features shall be supported:
 - a. Priority Levels
 - b. Device Group Control
 - c. PTZ Override (Lockout)
 - d. Proportional PTZ Control
 - e. Preset Lock via video screen
 - f. Preset Tour
- H. Video Archiving:
 - 1. The archiving feature shall be hardware independent, providing the ability to utilize commercial off-the-shelf mass storage devices as archived video destinations, including optical DVD, DAS, NAS, SAN, and other external storage drives.
 - 2. The archiving software shall provide the ability to manage and store video information from multiple recorded video locations to a central location.
 - 3. Each NVMS server shall have the ability to set its own unique archiving settings. Video shall automatically be archived based on user-defined "percentage full" settings. When the NVMS reaches the designated capacity threshold, video shall be automatically copied to the archive storage destination, and space on the source of the recorded video shall be released for overwrite by new video information using a first-in, first-out algorithm.
 - a. Exception: Video marked or tagged by the user or by automated alarm inputs shall be retained by the archiving process despite its location in the first-in, first-out timeline.
 - 4. Regardless of the video's storage location (local or in the archive), the NVMS software shall automatically retrieve video associated with an event on demand by the user in response to a search, browse, or other retrieval action. The actual storage location of the video shall be transparent to the user.
 - a. Exception: Video archived to removable media (e.g., removable hard drives or optical DVD) shall require prompting to the user to insert the appropriate media.

5. Archiving shall be capable of being scheduled such that archiving will only run during certain hours defined by the Owner.
6. The NVMS solution shall be permitted to utilize advanced algorithms for managing onboard storage such as reducing the frame rate of recorded video for the oldest video as an alternative to completely removing the video using a first-in, first-out algorithm. If this option exists in the NVMS software, it must have the following features:
 - a. Ability of the Owner to completely disable the feature.
 - b. Ability to set a minimum frame rate that the system will not exceed.
 - c. Ability to set the feature on a per-camera basis.
- I. Video Viewing Layouts:
 1. The NVMS shall support the ability to save the list of camera views currently being displayed, along with the currently selected template, with a user-defined name to be loaded as needed by the system operator.
 2. System operators shall have the ability to define multiple viewing templates that can be recalled and configured on an as-needed basis.
 3. This feature shall be subject to the access rights provided by the system administrator through their login credential.
- J. Still Image Capture/Save:
 1. During playback or monitoring of video, the system shall have the ability to create and save a still picture. This operation shall not affect any other operation and shall not alter the recorded video. The file format shall be an industry standard format (JPEG, TIFF) allowing for file transfer via e-mail, printing, or file transfer to other media.
 2. This feature shall be subject to the access rights provided by the system administrator through their login credential.
- K. Export Video Clip to File:
 1. The NVMS shall have to ability to save and export recorded video to a file (MPEG, AVI) for sharing and reviewing video clips. The start and end times for each video segment shall be user defined. The exported video clip shall be viewable via a standard Windows media player.
 2. This feature shall be subject to the access rights provided by the system administrator through their login credential.
- L. Automated Motion Video Searching:
 1. The system shall support advanced automated motion video searching against pre-recorded video. The automated motion video search shall analyze frames in a video segment to detect motion activity from image to image. It shall display thumbnail images of the frames with activity, complete with a histogram depicting the relative amount of activity within each frame.
 2. The search shall be defined by selecting a specific camera and a specific time period in which the suspected activity took place. All motion events associated with that camera and time period shall be displayed in either a trace or thumbnail format for review.
 3. Motion shall be capable of being restricted to any user-defined area of the screen as drawn by the user using a windowing tool in the software.
- M. Video System Analytics (VSA):
 1. The NVMS shall provide an embedded Video System Analytics solution.

2. The result of a trigger of an VSA shall be user definable and shall include:
 - a. Marking video.
 - b. Adjusting recording characteristics including frame rate and resolution.
 - c. Activating changes in the monitoring of cameras, including showing full screen video of the triggered camera.
 - d. Providing screen prompting to the system operator.
3. The set of Intelligent Video Analysis algorithms shall provide the following functionality:
 - a. Alert Types:
 - 1) Smart Video Motion Detection. This VSA shall have algorithms to filter out minor vibrations. The sensitivity of this filter shall be user adjustable. This VSA shall also provide motion masking where the user can define an area of the frame where motion will be ignored.
 - 2) Camera Tampering. When the VSA detects a camera is moved from its original position, when the camera view is obstructed, or when the focus is changed, this VSA shall activate.
 - 3) Sudden Change in Light Intensity. This VSA shall trigger when there is an extreme change in ambient light – light to dark or dark to light. The sensitivity of this VSA shall be user definable.
 - 4) New Object in Scene. This VSA shall detect an object that was not present when the VSA originally learned the scene or that has been inserted into the scene in a user defined area in the field of view.
 - 5) Object Removed from Scene. When an object that was present when the VSA originally learned the scene view has been removed from the scene, this VSA shall activate. This VSA shall be capable of being applied to a window of the total field of view as defined by the user.
 - 6) Specific Object Detected in Scene. This VSA shall trigger when an object is detected that is defined by specific properties including people, automobiles, or an object of a specific color.
 - 7) Congestion in Defined Area. This VSA shall occur when the VSA detects congestion in a specific area of the scene as defined by the user.
 - 8) Directional Motion VSA shall occur when the VSA detects an object moving in a direction specified in the setup of this feature.
 - 9) Object Crosses a Defined Region. This VSA shall detect an object moving across a virtual boundary or into a defined area from a specified direction.
 - 10) Moving Object Stops. This VSA shall detect when a moving object in the scene ceases to move.
 - 11) Static Object Starts to Move. VSA shall occur when the VSA detects when a static object in the scene starts to move.
 - 12) Object Moves Too Fast. This VSA shall trigger when an object is moving faster than a pre-defined speed.
 - 13) Loitering. This VSA shall detect when a person or group of people in the scene slows down or ceases to move for a specified period of time.

- 14) Detection of a Human Face. This VSA shall trigger when the VSA detects a frontal view of a human face.
 - 15) People Counting. This VSA shall be used when a camera is positioned in a top-down view of an entry/exit portal. This feature shall provide an alarm with a positive count for entry and a negative count for exit.
 - b. The VSA shall support the ability to store the graphical output for a specific event for use with VSA alarms. This feature shall allow the graphical output of a specific event to be stored as a file and later used as an overlay to be used and associated with an alarm for historical searching.
 - c. The VSA shall support CIF, 4CIF, and D1 video resolutions during video processing.
 - d. The VSA shall support video infrared imaging.
- N. Intelligent Audio Analysis:
1. The NVMS shall provide the ability to perform analysis on audio streams associated with recorded video.
 2. Supported audio analytics shall include high pitched sounds, impact sounds, or other dramatic changes to a defined ambient noise threshold.
 3. When searching for these audio alarms, the search shall include video stored locally or on an archive destination.
- O. The NVMS shall provide up to 10 different and independent programmable recording schedules.
1. The schedules may be programmed to provide different record frame rates for day, night, and weekend periods, as well as holidays and exception days.
 2. Advanced task schedules may also be programmed that could specify allowed log-on times for user groups, when events may trigger alarms, and when data backups and archiving should occur.
- P. The VMS shall support Dual Authorization logon. It shall function as follows:
1. Dual Authorization user groups may be created.
 2. Logon pairs, consisting of any two normal user groups, may be assigned to each Dual Authorization user group.
 3. A separate set of privileges and priorities can be assigned for each Dual Authorization user group.
 4. For each user group assigned as part of a logon pair, it shall be configurable whether the group can:
 - a. Log on either individually or as part of the logon pair.
 - b. Log on only as part of the logon pair.
 5. If a user that is part of logon pair logs on individually, then the user shall receive the privileges and priorities of the user's assigned user group. If the same user logs in as part of a logon pair, then the user shall receive the privileges and priorities assigned to the Dual Authorization group to which the pair is assigned.
- Q. The NVMS shall auto-discover cameras and encoders. Device detection shall support devices in different subnets.
- R. The NVMS shall be designed in such a way that server downtime or loss of communication to the server does not affect the functionality of the recording services. Normal recording and motion recording shall continue during server downtime.,

2.4 NVMS RECORDING REQUIREMENTS

- A. The NVMS shall provide management of the recording and playback of video, audio, and data (bookmarking, alarm data, etc.).
- B. Refer to the Camera Schedules on the project drawings for specific variables to be used on a per-camera basis for the purpose of calculating storage capacity and retention.
 - 1. Total distributed storage requirements shall be determined based on a minimum of 60 days storage retention.
 - 2. Cameras, unless otherwise noted on the Camera Schedule(s), shall be assumed to be recording 24 hours per day, 7 days per week, 365 days per year. Specific per-camera assumptions stated on the Camera Schedule for percent motion shall be used in the storage calculation.
 - 3. Compression shall be permitted to be used in the storage calculation. The compression algorithm (MPEG-4, H.264, etc.) shall be used on a per-camera basis. If the NVMS permits variable levels of compression intensity, the use of the "average" or "medium" level setting shall be used in the storage calculation unless otherwise noted.
 - 4. The Contractor shall provide the complete storage analysis and calculation as a shop drawing.
- C. Network Video Recorder (NVR) Hardware Platform:
 - 1. The NVR shall be defined as a storage device for recording IP video streams from IP cameras or from analog cameras that have been encoded to IP. In both cases, the NVR shall record IP streams from cameras or encoders located anywhere on the IP network without being direct-cable connected to the NVR.
 - 2. Refer to the project drawings for specific requirements, model numbers, and basis of design for the NVR.
 - 3. NVR Configuration:
 - a. The NVR shall contain one hard drive for the operating system and software, and all hard drive storage required to achieve the required storage retention.
 - 4. The NVMS shall provide a failover function where an NVR can be assigned as a backup to other NVRs. When an assigned NVR goes out of service, the failover NVR takes over the responsibilities of the failed NVR. When the primary NVR returns to service, the control shall be automatically transferred back to the primary NVR.
 - 5. It shall be possible to assign a redundant NVR to every NVR for use in normal operation of all NVR(s) in the system. The redundant NVR shall record the same streams as the primary NVR. The redundant NVR shall have its own disk drives where it shall store the recorded data.
 - a. It shall be possible to view the data recorded by the redundant NVR in the client software. The redundant NVR shall have camera symbols that can be placed in the camera selection tree. These cameras shall have the same name as the cameras of the primary NVR. An indication shall be provided to indicate that the camera names are located on the redundant NVR.

2.5 NVMS ALARM REQUIREMENTS

- A. The NVMS shall provide the capability to accept external alarm triggers in the following formats:
 - 1. Momentary or maintained low voltage contact closures
 - 2. Digital I/O (0 / 10V DC)
 - 3. RS-232 integration
 - 4. Custom integration
- B. Alarms shall be capable of being scheduled such that they are only active during defined times.
- C. The NVMS shall allow alarms to be individually restricted to specific user groups or users.
- D. A single alarm event shall be capable of activating a series of output events including:
 - 1. Mark recorded video.
 - 2. Initiate an email, text message, or both.
 - 3. Initiate an on-screen alarm prompt in a segmented "Alarm Queuing Window."
 - 4. Modify recorded video settings including resolution and frame rate.
 - 5. Modify video viewing options including bringing associated video full screen on any output.
- E. The alarm queue shall display alarms in order of their priority, with rows for higher priority alarms always displayed above lower priority alarm rows. The display order for equal priority alarms shall be selectable between new alarms displayed above existing alarms or new alarms displayed below existing alarms.
- F. Alarm Processing: The video management system shall operate as follows:
 - 1. When an alarm is accepted by a user, it shall be removed from the other users' alarm lists.
 - 2. The user shall be able to cancel acceptance of any alarm that has been previously accepted. In this case, the alarm shall re-appear in the alarm lists of all members of the user groups assigned to this alarm.
- G. The NVMS shall support the association of workflows with alarms. Workflows shall consist of action plans and comment boxes. An action plan shall display a text document, HTML page, or web site that typically contains instructions for handling the alarm. Comments entered in the comment boxes shall be logged in the system logbook.
 - 1. The NVMS shall be configurable to force an alarm workflow. In this case, the alarm cannot be cleared until the workflow is processed.
- H. The NVMS shall offer the possibility to automatically clear alarms when the originating event condition is no longer true.
- I. Alarms shall be capable of being configured to send cameras to defined positions.

2.6 NVMS INTERFACES AND INTEGRATIONS

- A. Security Management System Integration:
 - 1. Refer to the project drawings for all information regarding the Security Management System (SMS).
 - 2. The NVMS shall be integrated with the SMS to provide communication and alarm functionality between the two systems defined as follows, at a minimum:
 - a. Any alarm/event in the SMS shall have the ability to be associated with a digital video clip in real time.

- 1) The NVMS shall support user-defined video marking that includes time before and after the alarm event.
 - 2) SMS alarm events shall be capable of triggering a defined video sequence of operation.
 - b. The NVMS shall support NVMS PTZ control via the SMS video interface.
 - c. The integration shall support bidirectional alarm monitoring, alerting, and acknowledgement for either system from either system.
 - 1) Both alarm acknowledgement and alarm reset shall be supported.
 - d. Video Camera Groups/Video Camera Tours:
 - 1) The NVMS shall support camera grouping to allow for video camera tours in the SMS Alarm Monitoring Module.
 - 2) An unlimited number of camera groups shall be supported in the SMS, and each camera group shall support an unlimited number of cameras. Cameras within a camera group shall be capable of spanning any storage media. Individual cameras shall have the ability to be placed into multiple camera groups.
 - 3) The SMS shall provide for video camera tours that rotate live video between each of the cameras defined in the video camera group at a user-defined increment. The time increment shall be user definable in whole seconds.
3. The integration shall be:
- a. An integrated product from a single manufacturer, such that a single manufacturer supplies, supports, and warrants the entire solution including the integration.
 - b. An integration of two separate companies through ONLY an open API/SDK. The API/SDK integration must be complete, functional, and in use in the marketplace. The *ability* to integrate through an API/SDK without the integration being done in the marketplace is not acceptable. Custom or proprietary integrations are not acceptable.

2.7 ENCODERS

- A. Digital video encoder (Encoder) shall transmit video across the network for remote viewing and recording by the NVMS.
- B. Simultaneous transmission of multiple channel video across the LAN and WAN to connected network digital video recorders and master workstations shall be provided.
- C. Encoders shall be configurable remotely from the network.
- D. Encoders shall be capable of a minimum of 10 simultaneous viewing/recording streams per encoder.
- E. The LAN interface shall be 10/100/1000 Mbps, TCP/IP Unicast with DHCP support.
- F. Encoders shall feature an auto-reboot function that shall automatically initiate a reboot of the encoder when the system detects that the encoder is not responding.
- G. PTZ control of a PTZ camera connected to the encoder shall be supported from the user interface application over Ethernet.
- H. Video motion detection shall be built into the encoder. Video motion detection shall be monitored by the NVMS to only transmit over the network and record when motion is detected. This feature shall be capable of being turned off. When turned off, motion detection shall be capable of being done at the NVMS rather than at the encoder.

- I. Refer to the Material List for the technical requirements and model numbers for the encoders.

2.8 NVMS CABLING

- A. Refer to Division 27 for all cabling requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.
- C. Mount all cameras in the approximate locations shown on the drawings. Coordinate installation with other trades and utilities in the vicinity. Cameras containing fixed lenses, moved by more than 1'-0" from their location shown on the drawings, shall have a new lens calculation performed by the Contractor. Provide Architect/Engineer with results of lens calculation before proceeding with installation.
- D. Coordinate with Owner's IT Department to acquire network connections as well as any network configuration information, such as IP numbers, that will be required to connect NVMS to Owner network (if applicable).
- E. Provide all low voltage and +120 VAC power to all devices as required for proper system operation. Refer to Sections 26 05 33 and 26 05 13 for further requirements.
- F. All low voltage security wiring shall be routed with other low voltage cabling and shall use the cable tray to the fullest extent possible.
- G. Cabling shall be plenum rated when installed outside of conduit in plenum ceilings.

3.2 FIELD QUALITY CONTROL

- A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.
- B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the project drawings.
- C. It shall be the Contractor's responsibility to correct all inadequate picture quality issues prior to acceptance of the system.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Installation shall be performed by a factory-trained and certified Contractor.
 - 1. Provide a comprehensive, site-specific customer planning guide for the system. Conduct a conference with the Owner prior to any installation to discuss the programming options of the system and the planning guide. The result of this planning guide shall be the determination of the system options for each device and for the software.
- B. Include labor for all planning and all programming activities required to implement the Owner's operational preferences for each device and software. Any software programmable option, within the bounds of the capabilities of the hardware specified, shall be included.

- C. Provide a complete, functional system as described by the project drawings. These responsibilities include:
 - 1. Complete hardware setup, installation, wiring, and software configuration of the system, including all remote operator locations and all peripheral hardware.
 - 2. Complete programming of all hardware and software options in accordance with the Owner's preferences as determined by the planning guide conference.
 - 3. Programming of all custom graphic GUI screens including devices.
 - 4. Complete system diagnostic verification.

3.4 SYSTEM ACCEPTANCE

- A. Submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components and software. Perform the tests and document all results under the supervision of the manufacturer's system engineer.
- B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

3.5 SYSTEM DOCUMENTATION

- A. Complete documentation shall be provided for the system. The documentation shall describe:
 - 1. All operational parameters of the system.
 - 2. Complete documentation of all programming and options.
 - 3. Complete operating instructions for all hardware and software.
- B. The following sections shall be provided in the system documentation:
 - 1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
 - 2. User Manual: A step-by-step guide and instructions detailing all system user functions.
 - 3. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams, and schematic diagrams.

3.6 SYSTEM TRAINING

- A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.
- B. Provide two weeks advanced notice of training to the Owner.
- C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- D. At a minimum, the following training shall be conducted:
 - 1. System Administrators: A course detailing the system functions and operations. Provide configuration training on all aspects of the system.
 - 2. Users: Provide a detailed course outlining the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control, and general overview of the report hardware.

3. GUI Editing: Conduct detailed training on using the GUI editing software. Topics shall include the editing of existing graphical maps and the creation of new graphical maps.
- E. Minimum on-site training times shall be:
1. System Administrators: Three (3) days.
 2. Users: One (1) day.
 3. GUI Editing: One (1) day.

END OF SECTION

NVMS Bid Inventory Form

Item	Cost/Other
Total fixed (lump sum cost) for the entire project:	
Itemize the total fixed lump sum cost as follows:	
Software cost for NVMS including all implementation services.	
Cost for all camera hardware and associated accessories.	
Itemize software cost for the following (show the math):	
Fixed, non-reoccurring flat base cost (if any)	
Fixed, non-reoccurring per-camera licensing fee (if any)	
Recurring flat base cost (if any – do NOT include optional software maintenance agreement costs)	
Recurring flat per-camera licensing fee (if any)	
Client workstation licensing fees (if any)	
Remote Client licensing fees (if any)	
Mobile Client licensing fees (if any)	
Itemize all other license fees not included above.	
Add all required and optional software maintenance agreement costs (do NOT include in bid cost).	
Acknowledge receipt of addenda by writing addendum number to the right.	_____ through _____ inclusive

Include below Server Acknowledgement Statement per Section 28 23 00, Article 2.3, Paragraph D.

List below all separate software options, licensing or other monetary features that the Integrator interprets as *not* being requested by this RFP, but that are available from the NVMS manufacturer for purchase. Attach separate document if needed.

SECTION 28 31 00
FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire alarm and detection systems

1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.
- B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.
- C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 2. This person's name and certification number shall appear on the start-up and testing reports.

1.4 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. NFPA 72 - National Fire Alarm and Signaling Code
- C. NFPA 101 - Life Safety Code
- D. UL 2017 - General Purpose Signaling Devices and Systems

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.
 - 1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
 - 2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.
- B. Provide product catalog data sheets as shop drawings.
 - 1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings but required for the operation of the system.
 - 2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
 - 3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.
- C. Submit CAD floor plans as shop drawings:
 - 1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.

2. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.
- D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.
- E. Provide installation and maintenance manuals under provisions of Section 26 05 00.
- F. Submit manufacturer's certificate that system meets or exceeds specified requirements.
- G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.
- H. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.
 - a. Smoke and heat detectors, manual pull stations, duct smoke detectors, monitor modules, control modules and relays.
 - b. Notification appliances: Horn, horn strobes, and strobes.
 2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet [minimum of one (1) set each] and shall turn over to the Owner upon completion.
 3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 05 00.
- B. Store and protect products under provisions of Section 26 05 00.

1.8 REGULATORY REQUIREMENTS

- A. System: UL or FM Global listed.
- B. Conform to requirements of NFPA 101.
- C. Conform to requirements of Americans with Disabilities Act (ADA).
- D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.9 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.

- C. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.
- D. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.
- E. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.
- F. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.
- G. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown but shall be submitted on the shop drawings.

1.10 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 26 05 00.
- B. Include location of end-of-line devices.
- C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.
- D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.11 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 26 05 00.
- B. Include operating instructions, and maintenance and repair procedures.
- C. Include results of testing of all devices and functions.
- D. Include manufacturer's representative's letter stating that system is operational.
- E. Include the CAD floor plan drawings.
- F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.12 WARRANTY

- A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.
- B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Johnson Controls - Simplex
- B. Notifier by Honeywell
- C. Edwards - EST
- D. Siemens Fire Safety
- E. Gamewell - FCI

2.2 [FAP-#]: FIRE ALARM CONTROL PANEL (FAP)

- A. Control Panel: Modular, power-limited electronic design. Provide surface wall-mounted enclosure as shown on plans. Enclosure shall be minimum 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- B. Each Signaling Line Circuit (SLC loop) shall not be loaded over 80% of the maximum device capacity. For example, in the minimum system capacity column listed below, if the fire alarm manufacturer's system capacity of analog sensors per loop is 99 devices, then no more than 79 devices shall be wired on that loop. The minimum system capacity shall be as follows:

Minimum Total Addressable Points:	500
Minimum Total SLC loops (including board, ready for field connections):	4
Panel Expansion Capability, Minimum Total SLC loops:	10
Minimum Node capacity for Network System:	100
- C. Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC) Boards:
 - 1. Each board shall communicate directly with each addressable analog sensor and binary input to determine normal, alarm, or trouble conditions. Analog signals would be used for automatic test and determination of maintenance requirements.
 - 2. Each board shall contain its own microprocessor and shall be provided to monitor addressable inputs and to control addressable outputs (addressable relays). The board shall communicate and provide power to all devices on its loop over a single pair of wires, except where 4-wire devices require a separate power circuit.
 - 3. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.
 - 4. Pathway Class: SLC for addressable devices with less than 50 devices can be Class A or B, and more than 50 devices shall be Class A.
- D. Central Processing Unit:
 - 1. The central processing unit (CPU) shall communicate with the monitor and control all other modules in the panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the CPU.
 - 2. The CPU shall execute all control-by-event programs for specific action to be taken if a designated situation is detected in the system. A real-time system clock for time annotations on the display and printer shall be included.
 - 3. All power for the unit shall be supervised and supplied by the FAP.
- E. Display:
 - 1. The board shall provide all controls and indicators used by the system operator and may also be used to program all control panel parameters.
 - 2. The board shall provide an alphanumeric array for display of custom alphanumeric labels for all addressable points. It shall also provide indicators for AC Power, System Alarm, System Trouble, Display Trouble and Signal Silence.
 - 3. Displayed descriptions of addressable points shall include actual room names/numbers selected by the Owner. This information shall be obtained prior to programming. Room names/numbers shown on floor plans shall not be used.

4. The board shall provide a touch key-pad with control capability to command all system functions and entry of any alphanumeric information. Twenty different passwords with four levels of security shall be supported to prevent unauthorized manual control or programming.
- F. Memory: The CPU and display interface board shall be augmented by non-volatile field programmable memory. EPROM memory will also be allowed provided the memory is burned in with minimum expansion capability equal to the total system capacity of the panel. Memory shall not be lost upon primary and secondary power failure.
- G. Power Supply:
1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated emergency branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Identify/label breaker and branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.
 2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.
 3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.
 4. The power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of the entire system for 24 hours in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.
- H. Surge Protection:
1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.
 2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.
- I. Digital Communicator:
1. Provide dual phone line interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service. Communicator shall report in SIA and most major communication formats, with the capability of transmitting each device address point in a format compatible with the central station receiver.
 2. Communicator shall be fully supervised and shall operate on loop start phase lines ahead of the building PBX system.
 3. Communicator shall be FCC registered. Contractor shall provide two RJ31X jacks.
 4. Approvals: UL listed - UL 864/NFPA 72, FM approved.
 5. The communicator shall be provided integral to the fire alarm panel as furnished by the fire alarm panel manufacturer. If the panel construction requires a separate

unit, the unit shall be as manufactured by Silent Knight, Ademco, or fire alarm panel manufacturer approved equal.

2.3 SIGNALING LINE CIRCUIT DEVICES

A. [FA-120]: Smoke Detectors:

1. Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
2. Each smoke detector shall connect directly to an SLC loop.
3. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
4. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
5. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.
6. A test means shall be provided to simulate an alarm condition.
7. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.
8. Audible sounder detector base for sleeping room applications:
 - a. The audible base shall sound an alarm in the local room in UL2017 operation and UL484 for general evacuation. The unit shall be programmable by the main control panel for the duration of operation.
 - b. The audible sounder base shall sound Temporal 3 (fire) or Temporal 4 (CO alarm) and be at 75 dB at 10 feet.
9. A subscript is used to identify the device with a specific sequence of operation as follows: E=Elevator Recall, S=Sleeping/Patient Room, D=HVAC Control, A=Atrium, SW=Stairwell, CR=Computer Room, SD=Smoke Dampers, DH=Door Hold Release, FD= Fire Door Release, MP=Medical Procedure Room.

B. [FA-122]: Duct Smoke Detectors:

1. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
2. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, the Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
3. Provide a remote alarm LED indicator device (FA-240/241) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

C. Manual Pull Stations:

1. Manual stations shall match the description on the drawings (refer to the General Electrical Equipment Schedule). The stations shall be mounted where shown on the drawings and be provided with all necessary mounting hardware. Use surface

mount only on precast concrete or structure. WG subscript indicates wire guard is required.

2. **[FA-130]:** Addressable, double action with plastic breakrod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering.
3. **[FA-131]:** Addressable, double action with plastic breakrod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provide device with clear Lexan tamper resistant cover with integral 9V battery powered alarm that sounds when shield is lifted.
4. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
5. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

D. Heat Detectors:

1. **[FA-140]:** Combination rate of rise and 135°F fixed temperature analog thermal type sensor. Factory programmed to alarm at 135°F and at 15°F per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.
 - a. A subscript is used to identify the device with a specific sequence of operation as follows: E=Elevator Shutdown.
2. **[FA-141]:** 200°F fixed temperature. Provide a remote addressable monitor module to interface with addressable system as shown on the plans.
3. Provide a two-piece head/base design, with a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
4. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor all detectors in one room/area as shown on the drawings.
5. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.
6. Provide a remote LED indicator device if detector is not visible from a floor-standing position.
7. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. A connection for attachment of a remote indicator shall be provided.
8. A test means shall be provided to simulate an alarm condition.
9. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

E. **[FA-160]:** Monitor Modules:

1. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.
2. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.

3. The module shall supply the required power to operate the monitored device(s).
 4. The module shall provide address setting means using rotary decimal or DIP switches.
- F. **[FA-161]:** Addressable Relays:
1. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional slave relay(s), as required, rated for the electrical load being controlled (contractor to match voltage, amps, etc.).
 2. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
 3. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
 4. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

2.3 NOTIFICATION APPLIANCE DEVICES

- A. Device Color:
1. Wall Mounted: Red housing with white lettering or pictogram.
 2. Ceiling Mounted: Red housing with white lettering or pictogram.
- B. Visual Alarm Devices:
1. **[FA-200]:** Wall mounted.
 2. **[FA-201]:** Ceiling mounted.
 3. High intensity (candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
 - a. Candela Ratings: V1=15, V3=30, V7=75, VH=110, VS=177.
 4. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
 5. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
- C. Audio Horn Alarm Devices:
1. **[FA-210]:** Wall mounted.
 2. **[FA-230]:** Ceiling mounted.
 3. Sound Rating: 85 dB at 10 feet. Sound levels for alarm signals shall not exceed 120 dBA in the occupied area.
 4. Device shall be capable of a high and low dB level setting. Unless noted otherwise, the device shall be set to the high setting at building completion.
 5. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
- D. Combination Audio Horn and Visual Notification Device:
1. **[FA-211]:** Wall mounted.
 2. **[FA-231]:** Ceiling mounted.
 3. Combine horn and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.

- E. **[FA-203]:** Weatherproof Visual Notification Device:
 - 1. High intensity strobe, square housing, 75 candela rating, suitable for wet locations. Provide with weatherproof back box.
 - 2. Mounting: Semi-flush wall.
 - 3. Conduit shall not be exposed.
- F. **[FA-212]:** Weatherproof Audio/Visual Notification Device:
 - 1. Electronic horn with high intensity strobe, square housing, 75 candela, suitable for wet locations. Provide with weatherproof back box.
 - 2. Mounting: Semi-flush wall.
 - 3. Conduit shall not be exposed.

2.4 [NEP-#]: NAC EXTENDER PANELS (NEP)

- A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NEP on the shop drawing submittals.
- B. Each NEP shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NEP provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.
- C. Power for each NEP shall be from a local 120 VAC emergency circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NEP from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with Architect/Engineer prior to installation.
- D. NAC extender panels may be installed only in locations coordinated with the Architect/Engineer.
- E. Mounting: Surface.

2.5 ANNUNCIATION

- A. **[FAA-#]:** Remote LCD Annunciators:
 - 1. Auxiliary annunciators shall indicate alarm and trouble conditions visually and audibly as shown on the drawings. Provide local TROUBLE ACKNOWLEDGE, TEST, and ALARM SILENCE capability. Minimum 80-character display.
 - 2. Communications and power to the annunciators shall be supervised. The annunciator shall receive power from the fire alarm control panel.
 - 3. A single key switch shall enable all switches on the annunciator.
 - 4. Mounting: Flush.
- B. **[FA-241]:** Fire Alarm Remote Indicator:
 - 1. Red LED type.
 - 2. Mounts flush to a single gang box.
- C. **[FA-242]:** Fire Alarm Remote Indicator and Test Switch:
 - 1. Red LED type.
 - 2. Key switch test selector.
 - 3. Mounts flush to a single gang box.

2.6 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

- A. **[FA-254]:** Duct Smoke Detector and Smoke Damper Control:
 - 1. Sampling type duct detector [FA-122] in ducts 18" and larger. In-duct smoke detector [FA-123] in ducts less than 18". Detector shall be mounted within 5' of smoke damper. Motorized type 24 VDC, smoke damper furnished and installed by MC. Fire alarm control and power connections by EC. Remote indicator [FA-241] or [FA-242] mounted in visible location. Provide auxiliary relay base or addressable control module. The smoke damper shall close upon activation of the detector, and a supervisory signal shall be sent to the fire alarm control panel.
- B. **[FA-260]:** Flow Switch:
 - 1. Connection to flow switch to monitor fire protection flow switch or discharge output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
- C. **[FA-261]:** Monitor Switch:
 - 1. Connection to monitor switch to monitor fire protection system supervisory switches or output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
- D. **[FA-262]:** Post Indicator Valve:
 - 1. Connection to post indicator valve for sprinkler system supervisory notification. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC. Provide surge protection device as recommended by the fire alarm system manufacturer online entering/leaving the facility.
- E. **[FA-263]:** Electronic Bell:
 - 1. Electronic bell for sprinkler alarm, electro-mechanical type, 120 VAC. Furnished and installed by MC. Fire alarm control and power connections by EC.

2.7 WIRING

- A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with NFPA 70, Article 760 for power-limited fire alarm signal service.
- B. Approved manufacturers of fire alarm cable:
 - 1. Comtran Corp.
 - 2. Helix/HiTemp Cables, Inc.
 - 3. Rockbestos-Suprenant Cable Corp.
 - 4. West Penn Wire/CDT.
 - 5. Radix.

PART 3 - EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

- A. General:
 - 1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.
 - 2. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

- B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:
 - 1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
 - 2. A local signal in the control panel shall sound.
 - 3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
 - 4. history storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
 - 5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
- C. Audible Alarms Sequence:
 - 1. Audible alarms throughout the building shall sound.
- D. Visual Alarms Sequence:
 - 1. Visual alarms throughout the building shall flash.
- E. Fire Protection Electric Sprinkler Bell Sequence:
 - 1. The fire alarm shall utilize an addressable relay to energize the electric sprinkler bell upon activation of the flow switch.
- F. Double Interlocked Preaction Sprinkler Activation Sequence:
 - 1. The fire alarm system shall utilize an addressable relay to signal the double-interlock preaction sprinkler system to allow filling with water upon initiation of alarm in zone of sprinkler coverage.
 - 2. Where there are multiple zones to the preaction system, a separate addressable relay shall be provided for each zone and the system shall be programmed to signal only the zone that is in the area of the fire. Coordinate with the fire protection system installer.
 - 3. The fire alarm system shall utilize addressable monitor modules to monitor the control panel supervisory and trouble conditions.
- G. AHU and Mechanical Fan Shutdown Sequence:
 - 1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
 - 2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
 - 3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.

3.2 INSTALLATION

- A. Install system in accordance with manufacturer's instructions and referenced codes.
- B. Fire Alarm Control Panel:
 - 1. Install the control panel where shown on the drawings.
 - 2. All expansion compartments, if required, shall be located at the control panel.

- C. Devices:
1. General:
 - a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
 - b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
 - c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
 - d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall adjust location of device so that new location meets all requirements in NFPA 72 and all applicable building codes.
 2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.
 3. Protection of Fire Alarm System:
 - a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.
 4. Analog Smoke and Heat Detectors:
 - a. In elevator shafts and elevator equipment rooms, provide a heat detector for elevator shutdown within 2' of every sprinkler head. Coordinate with fire protection contractor.
 5. Duct-type Analog Smoke Detectors:
 - a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
 - b. All detectors shall be accessible.
 - c. Duct-type detectors shall be installed according to the manufacturer's instructions.
 6. Manual Pull Stations:
 - a. Stations shall be located where shown and at the height noted on the drawings.
 7. Addressable Relays and Monitor Modules:
 - a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.

- b. All modules shall be mounted in or on a junction box in an accessible location.
 - c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.
 - 8. SLC Loop Isolation Modules:
 - a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.
 - b. Install all Isolation Modules within the fire alarm control panel, unless otherwise indicated on the drawings. Refer to the fire alarm riser diagram for requirements. Refer to the floor plans for areas served by separate isolation modules.
 - 9. Notification Appliance Devices:
 - a. Devices shall be located where shown on the drawings.
 - b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
 - c. Where ceiling mounted visual alarm devices or combination audio/visual alarm devices are shown where the ceiling is greater than 30'-0" high, they shall be stem mounted so that the entire unit is below 30'-0". This does not apply to audio-only alarm devices.
- D. Annunciators:
 - 1. Remote Annunciators: The annunciators shall be located where shown on the drawings and approved by the fire marshal.
- E. Wiring:
 - 1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
 - 2. Wiring shall be installed in conduit. Refer to Identification Section 26 05 13 for color and identification requirements.
 - 3. All junction boxes with SLC and NAC circuits shall be identified on cover.
 - 4.
 - 5. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 13.
 - 6. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.
 - a. Fire alarm temporal audible notification for all audio appliances.
 - b. Synchronization of all visual devices where two or more devices are visible from the same location.
 - c. Ability to silence audible alarm while maintaining visual device operation.
 - 7. Notification Appliance Circuits shall not span floors
 - 8. Signal line circuits connecting devices shall not span floors or
 - 9. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its

terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

- F. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows or using colored tape at each conductor termination and in each junction box.
 - 1. Power branch circuit conductors: In accordance with Section 26 05 53.
 - 2. Signaling line circuit: Overall red jacket with black and red conductors.
 - 3. DC power supply circuit: Overall red jacket with violet and brown conductors.
 - 4. Notification appliance circuit: Overall red jacket with blue and white conductors.
 - 5. Door release circuit: Gray conductors.
 - 6. Central station trip circuit: Orange conductors.
 - 7. Central station fire alarm loop: Black and white conductors.
- G. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.
- H. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 26 05 00.
- B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.
- C. Contractor shall test and adjust the fire alarm system as follows:
 - 1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
 - a. 70dBA.
 - b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
 - c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
 - d. As specified on the drawings.
 - 2. Sound level measurement procedure shall meet the following requirements:
 - a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
 - b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
 - c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
 - d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
 - e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
 - f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of 2 rooms shall be tested. The results from the rooms tested

shall be averaged and the remaining rooms may be adjusted per the average.

- g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.
- h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Section 26 05 00.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.
- C. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. The Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

3.5 SYSTEM TRAINING

- A. System training shall be performed under provisions of Section 26 05 00.
- B. Minimum on-site training times shall be:
 - 1. System Operators: One (1) day.

END OF SECTION

