

PROJECT MANUAL
for
2505
Our Lady of the Lake
St. Elizabeth MOB 3

1125 W. Hwy 30
Gonzales, LA 70737

May 18, 2026

Prepared By:

Ritter Maher Architects
Scott A. Ritter, AIA



SECTION 000110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

- 000101 - Project Title Page
- 000103 - Project Directory
- 000110 - Table of Contents
- 002113 - Instructions to Bidders
- 004100 - Bid Form
- 004336 - Proposed Subcontractors Form
- 005000 - Contracting Forms and Supplements
- 007200 - General Conditions
- 007300 - Supplementary Conditions

SPECIFICATIONS

Division 01 – GENERAL REQUIREMENTS

- 011401 - Site Work Restrictions
- 012000 - Price and Payment Procedures
- 012200 - Unit Prices
- 012300 - Alternates
- 013000 - Administrative Requirements
- 014000 - Quality Requirements
- 015000 - Temporary Facilities and Controls
- 015614 - Temporary Barriers and Enclosures
- 016000 - Product Requirements
- 017000 - Closeout Requirements
- 017419 - Construction Waste Management and Disposal

Division 02 – EXISTING CONDITIONS

- 024100 - Demolition

Division 03 – CONCRETE

- 031000 - Concrete Formwork & Form Accessories
- 032000 - Concrete Reinforcement & Reinforcement Supports
- 033000 - Cast-In-Place Concrete

Division 04 – MASONRY

- 040511 - Masonry Mortaring and Grouting
- 042223 - Architectural Concrete Unit Masonry

042613 - Masonry Veneer

047200 - Cast Stone Masonry

Division 05 – METALS

051200 - Structural Steel Framing

052100 - Steel Joists

053113 - Steel Composite Floor Deck

053123 - Steel Roof Deck

054100 - Cold-formed Metal Framing

055100 - Metal Stairs

057311 - Decorative Metal and Glazed Metal Railings

Division 06 – WOODS, PLASTICS, AND COMPOSITES

061000 - Rough Carpentry

064116 - Plastic Laminate-Faced Architectural Cabinets

Division 07 – THERMAL AND MOISTURE PROTECTION

072100 - Thermal Insulation

072423 - Direct Applied Stucco Finish System

072500 - Weather Barriers

074213 - Composite Metal Wall Panels

075400 - Thermoplastic Membrane Roofing

076200 - Sheet Metal Flashing and Trim

077200 - Roof Accessories

078100 - Applied Fire Protection

078400 - Firestopping

079200 - Joint Sealants

Division 08 – OPENINGS

081113 - Hollow Metal Doors and Frames

081400 - Plastic Laminate-Faced Wood Doors

083485 - Fire Rated Automatic Smoke Curtains

083490 - Hose Stream Rated Smoke and Fire Curtain

087100 - Door Hardware

088000 - Glazing

Division 09 – FINISHES

090561 - Common Work Results for Flooring Preparation

092116 - Gypsum Board Assemblies

093000 - Tiling

095113 - Acoustical Panel Ceilings
095423 - Linear Metal Ceilings
096500 - Resilient Flooring
096623 - Resinous Matrix Terrazzo Flooring
096813 - Tile Carpeting
097200 - Wall Coverings
099000 - Paints and Coatings

Division 10 -- SPECIALTIES

101400 - Signage and Graphics
102113 - Toilet Compartments
102600 - Wall And Door Protection
102800 - Toilet, Bath, and Laundry Accessories
104400 - Fire Protection Specialties

Division 11 -- EQUIPMENT

117000 - Medical Equipment

Division 12 -- FURNISHINGS

122400 - Window Shades
123600 - Countertops

Division 14 -- CONVEYING EQUIPMENT

142123 - Electric Traction Passenger Elevator

Division 21 -- FIRE SUPPRESSION

210000 - Fire Suppression General Requirements
210010 - Fire Suppression Basic Materials and Methods
210020 - Fire Suppression Piping Systems
210030 - Fire Suppression Piping Materials
210040 - Fire Suppression System

Division 22 -- PLUMBING

220000 - Plumbing General Requirements
220010 - Plumbing Basic Materials and Methods
220020 - Plumbing Piping Systems
220030 - Plumbing Piping Materials
220040 - Plumbing Equipment and Specialties
220050 - Plumbing Fixtures and Accessories

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

- 230000 - HVAC General Requirements
- 230010 - HVAC Basic Materials and Methods
- 230020 - Sheet Metal Work
- 230021 - Round and Flat Oval Duct Fittings
- 230030 - HVAC Piping Systems
- 230040 - HVAC Piping Materials
- 230050 - HVAC Equipment and Specialties
- 230060 - HVAC Temperature Controls

Division 26 -- ELECTRICAL

- 260500 - Common Work Electrical Results
- 260519 - Low-Voltage Electrical Power Conductors and Cables
- 260526 - Grounding And Bonding for Electrical Systems
- 260529 - Hangers And Supports for Electrical Systems
- 260533 - Raceway And Boxes for Electrical Systems
- 260553 - Identification For Electrical Systems
- 260573 - Overcurrent Protective Device Coordination Study
- 260923 - Lighting Control Devices
- 262200 - Low-Voltage Transformers
- 262413 - Switchboards
- 262416 - Panelboards
- 262700 - Electrical Power Monitoring and Metering
- 262726 - Wiring Devices
- 262816 - Enclosed Switches and Circuit Breakers
- 263213 - Engine-driven Generator Sets – Diesel
- 263600 - Automatic Transfer Switches
- 264113 - Lightning Protection System
- 265100 - Interior Lighting

Division 27 -- COMMUNICATIONS

- 270000 - Communications General Requirements
- 270528 - Communications Raceways, Pathways, and Grounding
- 271000 - Communications Cabling
- 274133 - CATV Distribution System
- 275113 - Overhead Paging System

Division 28 -- ELECTRONIC SAFETY AND SECURITY

- 281000 - Access Control System
- 283111 - Digital Addressable Fire Alarm

Division 31 -- EARTHWORK

31 6329 - Drilled Cast-In-Place Concrete Shafts

END OF SECTION

MECHANICAL SPECIFICATIONS

The following Specification Sections were prepared by me or under my direct personal supervision:



Assaf, Simoneaux, Tauzin & Associates, Inc.

DIVISION 21 – FIRE SUPPRESSION	
210000	FIRE SUPPRESSION GENERAL REQUIREMENTS
210010	FIRE SUPPRESSION BASIC MATERIALS AND METHODS
210020	FIRE SUPPRESSION PIPING SYSTEMS
210030	FIRE SUPPRESSION PIPING MATERIALS
210040	FIRE SUPPRESSION SYSTEM
DIVISION 22 – PLUMBING	
220000	PLUMBING GENERAL REQUIREMENTS
220010	PLUMBING BASIC MATERIALS AND METHODS
220020	PLUMBING PIPING SYSTEMS
220030	PLUMBING PIPING MATERIALS
220040	PLUMBING EQUIPMENT AND SPECIALTIES
220050	PLUMBING FIXTURES AND ACCESSORIES
DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING	
230000	HVAC GENERAL REQUIREMENTS
230010	HVAC BASIC MATERIALS AND METHODS
230020	SHEET METAL WORK
230021	ROUND AND FLAT OVAL DUCT FITTINGS
230030	HVAC PIPING SYSTEMS
230040	HVAC PIPING MATERIALS
230050	HVAC EQUIPMENT AND SPECIALTIES
230060	HVAC TEMPERATURE CONTROLS

(END OF MECHANICAL)

SECTION 000103 – PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Identification of project team members and their contact information.

1.02 OWNER:

- A Name: FMOL
 - 1. Address Line 1: 5217 Flanders Drive
 - 2. City: Baton Rouge
 - 3. State: Louisiana
 - 4. Zip Code: 70808
 - 5. Contacts:
 - a. Ross Collins; Ross.Collins@fmlhs.org
 - b. Paula Sonnier Melear; Paula.Sonnier@fmlhs.org

1.03 CONSULTANTS:

- A Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 1. Company Name: Ritter Maher Architects (Scott A. Ritter, AIA)
 - a. Address Line 1: 2987 Government Street, 2nd Floor
 - b. City: Baton Rouge
 - c. State: Louisiana
 - d. Zip Code: 70806
 - e. Telephone: 225.383.4321
 - 2. Contacts:
 - a. Aidan Gale; agale@rittermaher.com
 - b. Branden Leger, AIA; bleger@rittermaher.com
 - c. Scott A. Ritter, AIA; sritter@rittermaher.com

- B Interior Designer:

1. Company Name: Ritter Maher Architects
 - a. Address Line 1: 2987 Government Street, 2nd Floor
 - b. City: Baton Rouge
 - c. State: Louisiana
 - d. Zip Code: 70806
 - e. Telephone: 225.383.4321
 2. Primary Contact:
 - a. Samantha Bastion; sbastion@rittermaher.com
- C Electrical Engineering Consultant:
1. Company Name: RME Consultants, LLC
 - a. Address Line 1: 5713 Superior Drive
 - b. City: Baton Rouge
 - c. State: Louisiana
 - d. Zip Code: 70816
 - e. Telephone: 225.936.0816
 2. Primary Contact:
 - a. Ryan Moore, PE; rmoore@rmeconsultants.net
- D Mechanical and Plumbing Engineering Consultant:
1. Company Name: AST Engineers
 - a. Address Line 1: 8417 Kelwood Avenue
 - b. City: Baton Rouge
 - c. State: Louisiana
 - d. Zip Code: 70806
 - e. Telephone: 225.926.5600
 2. Primary Contact:
 - a. Jordan Fish, PE; jfish@astengineers.us

E Structural Engineer

1. Company Name: Wardlaw Lasseigne Lebouef, LLC
 - a. Address Line 1: 554 Colonial Drive
 - b. City: Baton Rouge
 - c. State: Louisiana
 - d. Zip Code: 70806
 - e. Telephone: 225.926.1432
2. Primary Contact:
 - a. Ryan Lebouef, PE; rlebouef@wl-structure.com

F Civil Engineer & Landscape Design

1. Company Name: Duplantis Design Group
 - a. Address Line 1: 3690 Burbank Drive
 - b. City: Baton Rouge
 - c. State: Louisiana
 - d. Zip Code: 70808
 - e. Telephone: 225.751.4490
2. Primary Contact:
 - a. Dylan Miller, PE; dmiller@ddgpc.com

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 002113 - INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 DOCUMENT INCLUDES

- A. Invitation
- B. Bid Documents and Contract Documents
- C. Site Assessment
- D. Qualifications
- E. Bid Submission
- F. Bid Enclosures/Requirements
- G. Offer Acceptance/Rejection

1.02 RELATED DOCUMENTS

- A. Document 004100 - Bid Form.
- B. Request for Proposals for General Contracting Services

INVITATION

2.01 BID SUBMISSION

- A. Bids signed and under seal, executed, and dated will be received by email to Scott Ritter; sritter@rittermaher.com until **2 p.m. on June 23, 2026**, in the format listed within the RFP.
- B. Email Carbon Copy recipients listed within the RFP.
- C. Offers submitted after the above time will not be accepted.
- D. Offers will be opened and reviewed privately after the time for receipt of bids.
- E. Refer to Request for Proposals for additional requirements.

2.02 INTENT

- A. The intent of this Bid request is to obtain an offer to perform work to complete the project named 2505 Our Lady of the Lake St. Elizabeth MOB 3 for a Stipulated Sum contract, in accordance with Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract is comprised of demolition, renovation, site work and general construction work.
- B. Project Location:
 - Our Lady of the Lake St. Elizabeth Hospital
 - 1125 W. Highway 30
 - Gonzales, Louisiana 70737

2.04 CONTRACT TIME

- A. Identify Contract Time in the Bid Form. The completion date in the Agreement shall be the Contract Time added to the commencement date.

- B. Owner requires that the work of this contract be completed as quickly as possible and consideration will be given to time of completion when reviewing the submitted bids.

BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 AVAILABILITY

- A. 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.

3.02 INQUIRIES/ADDENDA

- A. Direct questions in writing to:
 - 1. Aidan Gale, email: agale@rittermaher.com
 - 2. cc: Branden Leger, email: bleger@rittermaher.com
- 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. Clarifications requested by bidders must be in writing not less than 4 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 Owner's Project Manager.

3.03 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

- A. General Requirements for Substitution Requests:
 - 1. Project Manual establishes standards for products, assemblies, and systems.
 - 2. Submit requests only for elements for which substitution is specifically allowed in the Project Manual.
 - 3. Provide sufficient information to determine the acceptability of proposed substitutions.
 - 4. Provide complete information on required revisions to other work to accommodate each proposed substitution.
 - 5. Submit any requests for consideration to:
 - a. Aidan Gale, email: agale@rittermaher.com
 - b. cc: Branden Leger, email: bleger@rittermaher.com
- B. Substitution Request Time Restrictions:
 - 1. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 4 days before receipt of bids.
- C. Review and Acceptance of Request:
 - 1. Architect may approve the proposed substitution and will issue an Addendum to known bidders.
 - 2. For approved substitutions, include representation of changes in the bid, if any, 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 will not be considered.

SITE ASSESSMENT

4.01 SITE EXAMINATION

- A. Examine the project site before submitting a bid.
- B. The bidder is required to contact Architect at the following email address to arrange a date and time to visit the project site: Aidan Gale, email: agale@rittermaher.com

4.02 PREBID CONFERENCE

- A. A mandatory bidders conference has been scheduled for **2 p.m. on May 28, 2026** at the location of 5217 Flanders Drive, Baton Rouge, LA.
- B. All general contract bidders and suppliers are invited.
- C. Representatives of Architect and Owner will be in attendance.
- D. Summarized minutes of this meeting will be circulated to attendees. These minutes will not form part of Contract Documents.
- E. Information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.

QUALIFICATIONS

5.01 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Owner reserves the right to reject a proposed subcontractor for reasonable cause.
- B. Refer to Section 013000 Administrative Requirements for approved Subcontractors.

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. Email executed Bid Submission as a single PDF attachment. If PDF is too large for attachment, a Google Drive or Dropbox link will be accepted.
- C. Label subject line of Bid Submission email: **2505 OLOL St. Elizabeth MOB 3 - (General Contractor's Name) Bid Submission**

6.02 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed, conditional, illegible, obscure, contain arithmetical errors, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.
- B. Bids are by invitation, only from selected bidders.

BID ENCLOSURES/REQUIREMENTS

7.01 BID FORM REQUIREMENTS

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

7.02 SELECTION AND AWARD OF ALTERNATES

- A. Indicate variation of bid price for Alternates. Unless otherwise stated, indicate Alternates as a difference in bid price by adding or deducting from the base bid price.
- B. Bids will be evaluated on the total of the base bid price and all Alternates. After determination of the successful bidder, consideration will be given to which Alternates will be included in the Work.

7.03 UNIT PRICES

- A. Where indicated in the Bid Form, provide Unit Prices for the items listed. Unit Prices shall represent the cost per unit of measure for adding or deducting the identified scope from the Work, including all labor, materials, equipment, overhead, and profit.
- B. Unit Prices shall remain in effect for the duration of the Contract. Owner reserves the right to use submitted Unit Prices to adjust the Contract Sum for additions to or deductions from the Work as authorized by Change Order.
- C. Bids will be evaluated on the Base Bid price. Unit Prices will be considered in the evaluation of bids where quantities or scope of certain items of work cannot be fully determined at the time of bidding.

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.
- B. After acceptance by Owner, Architect on behalf of Owner, will issue to the successful bidder, a written Bid Acceptance.

END OF SECTION

SECTION 004100 - BID FORM

THE PROJECT AND THE PARTIES

1.01 TO:

- A. Owner
FMOL
5217 Flanders Drive
Baton Rouge, Louisiana 70808

1.02 FOR:

- A. Project
2505 OLOL St. Elizabeth MOB 3
1125 W. Hwy 30
Gonzales, Louisiana 70737

1.03 DATE: _____ (BIDDER TO ENTER DATE)

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

- A. Bidder's Full Name _____
1. Address _____
2. City, State, Zip _____

1.05 OFFER

- A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Bid Documents prepared by Ritter Maher Architects for the above-mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

_____ dollars

(\$ _____), in lawful money of the United States of America.

1. General Contractor's Overhead and Profit _____ %
B. All applicable federal taxes and State of Louisiana taxes are included in the above listed Bid Sums

1.06 ALTERNATES

- A. The following amounts shall be added to or deducted from the above referenced Base Bid amounts.

1. **Alternate No. 1:** Builder's Risk Insurance

Add/Deduct:

_____ DOLLARS
\$ _____

2. **Alternate No. 2:** DOAS-1, associated ductwork and associated KEF-1

Add/Deduct

_____ DOLLARS
\$ _____

1.07 UNIT PRICES

- A. The following are Unit Prices for specific portions of the Work as listed and are applicable to authorized variations from the contract documents.

1. Item # 01: Alternate Flooring Adhesive price per square foot

_____ DOLLARS
\$ _____

2. Item # 02: Remedial Floor Coating price per square foot

_____ DOLLARS
\$ _____

1.08 TENANT IMPROVEMENT SUITE COSTS

- A. Refer to the drawings for suite number, location, and scope of work for each Tenant Improvement. For each Suite shown on the drawings, provide the total Tenant Improvement cost, expressed as a price per square foot of tenant suite area. Suite areas are as indicated in the drawings.
- B. These prices do not alter the Base Bid Sum and will be used by the Owner for informational purposes.
- C. Provide one entry per suite. If additional suites are required beyond those listed, attach supplemental sheets using the same format.

Suite No. _____ Tenant Improvement Cost:
_____ DOLLARS
\$ _____ per square foot (Suite Area: _____ SF)

Suite No. _____ Tenant Improvement Cost:
_____ DOLLARS
\$ _____ per square foot (Suite Area: _____ SF)

Suite No. _____ Tenant Improvement Cost:
_____ DOLLARS
\$ _____ per square foot (Suite Area: _____ SF)

Suite No. _____ Tenant Improvement Cost:
_____ DOLLARS
\$ _____ per square foot (Suite Area: _____ SF)

Suite No. _____ Tenant Improvement Cost:
_____ DOLLARS
\$ _____ per square foot (Suite Area: _____ SF)

Suite No. _____ Tenant Improvement Cost:
_____ DOLLARS
\$ _____ per square foot (Suite Area: _____ SF)

1.09 ACCEPTANCE

- A. This offer shall be open to acceptance and is irrevocable for thirty (30) 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 days of receipt of Notice of Award.
 - 2. Commence work within seven days after written Notice to Proceed of this bid.

1.10 CONTRACT TIME

- A. If this Bid is accepted, we will:
- B. Complete the Work in _____ calendar days from Notice to Proceed.

1.11 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. 10% percent overhead and profit on the net cost of our own Work;
 - 2. 10% maximum on the cost of work performed by any Subcontractor. Subcontractors shall not charge in excess of 10% on any Change to the Work.
- B. On work deleted from the Contract, our credit to Owner shall be Architect-approved net cost, per the Master Services Agreement.

1.12 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.

Addendum # _____

1.13 BID FORM SUPPLEMENTS

- A. The following information and associated costs are included with this Bid submission:
 - 1. Performance Bond
- B. The following Supplements are attached to this Bid Form and are considered an integral part of this Bid Form:
 - 1. Response to Request for Proposal
- C. We agree to submit the following Supplements to Bid Forms within 24 hours after submission of this bid for additional bid information:
 - 1. Proposed Schedule of Values, inclusive of line item for General Contractor's fee.
 - 2. General Contractor's Preliminary Construction Schedule, aligning with 1.09 Contract Time.
 - 3. Document 004336 - Proposed Subcontractors Form: Include the names of all Subcontractors and the portions of the Work they will perform.

1.14 BID FORM SIGNATURE(S)

- A. The Corporate Seal of

- B. (Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

(Authorized signing officer, Title)

END OF SECTION

SECTION 004336 - PROPOSED SUBCONTRACTORS FORM

PARTICULARS

1.01 Herewith is the list of subcontractors referenced in the bid submitted by:

(Bidder) _____

1.02 Dated _____ and which is an integral part of the bid form.

1.03 The following work will be performed (or provided) by subcontractors and coordinated by us:

List of Subcontractors

Work Subject / Subcontractor name

- A. _____
- B. _____
- C. _____
- D. _____
- E. _____
- F. _____
- G. _____
- H. _____
- I. _____
- J. _____
- K. _____
- L. _____
- M. _____
- N. _____
- O. _____
- P. _____
- Q. _____
- R. _____

END OF SECTION

SECTION 005000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. See Section 007200 - General Conditions
- B. See Section 007300 - Supplementary Conditions
- C. The Agreement is based on AIA A121 Standard Form of Master Agreement Between Owner and Contractor

1.02 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.
- B. Bond Forms:
 - 1. 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. Interim Life Safety Measures
 - 1. ILSM Policy Reference #ECLS001 (Attachment)
 - 2. Life Safety Assessment (Attachment)
 - 3. ISLM Evaluation Record, Matrix, Flow Chart, and Checklist (Attachment)
 - 4. Daily and Monthly Inspection Sheets (Attachment)
 - 5. ILSM Notification Exit Closure (Attachment)
 - 6. Requirements for Daily Fire Inspection (Attachment)
 - 7. Requirements for Temporary Fire Watch (Attachment)
 - 8. ILSM Education/Training Sign-In Form (Attachment)
 - 9. The Commissioning and Decommissioning of Life Safety Items During Construction/Renovation Form (Attachment)
- E. Other Forms:
 - 1. OLOL Pre-Construction Risk Assessment (Attachment)
 - 2. OLOL Infection Control Risk Assessment (Attachment)
 - 3. OLOL Hot Work Permit (Attachment)
 - 4. OLOL Service Shut-down Confirmation (Attachment)
 - 5. OLOL Medical Gas Shutdown – Stakeholder Sign-Off Sheet (Attachment)

F. Our Lady of the Lake Close-out Templates:

1. Addenda Cover Page (Attachment)
2. As-Built Cover Page (Attachment)
3. ASI Cover Page (Attachment)
4. Certificate Of Occupancy Cover Page (Attachment)
5. Close Outs Cover Page (Attachment)
6. Electrical Cover Page (Attachment)
7. Finish Floor & Walls Cover Page (Attachment)
8. Finish Hardware Cover Page (Attachment)
9. Fire Marshal Cover Page (Attachment)
10. HVAC Cover Page (Attachment)
11. ICRA Cover Page (Attachment)
12. One-Year Warranty Cover Page (Attachment)
13. Plumbing Cover Page (Attachment)
14. Special Warranty Cover Page (Attachment)
15. Specialties Cover Page (Attachment)
16. Substantial Completion Cover Page (Attachment)

1.03 REFERENCE STANDARDS

- A. AIA A201 - General Conditions of the Contract for Construction; 2017
- B. AIA A121 - Standard Form of Master Agreement Between Owner and Contractor; 2018
- C. AIA A221 – Work Order for use with Master Agreement Between Owner and Contractor; 2018 (Attachment)
- D. AIA A305 - Contractor's Qualification Statement, 2020
- E. AIA A312 - Performance Bond and Payment Bond; 2010
- F. AIA G702 - Application and Certificate for Payment; 1992
- G. AIA G703 - Continuation Sheet; 1992

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

DRAFT AIA® Document A221™ – 2018

Work Order for use with Master Agreement Between Owner and Contractor

WORK ORDER number « » made as of the « » day of « » in the year « »
(In words, indicate day, month, and year.)

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

« »
« »
« »
« »

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

« »
« »
« »
« »

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

« »
« »
« »

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

« »
« »
« »
« »

THE CONTRACT

This Work Order, together with the Contract Documents enumerated herein, including the Master Agreement between Owner and Contractor dated the « » day of « » in the year « »
(In words, indicate day, month, and year.)

form the Contract.

The Owner and Contractor agree as follows.

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

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

This document provides the Contractor's scope of Work, and related information, and is intended to be used with AIA Document A121™– 2018, Standard Form of Master Agreement Between Owner and Contractor where Work is provided under multiple Work Orders.

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

TABLE OF ARTICLES

- 1 THE WORK OF THIS WORK ORDER
- 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 3 CONTRACT SUM
- 4 PAYMENTS
- 5 INSURANCE AND BONDS
- 6 PARTY REPRESENTATIVES
- 7 ENUMERATION OF CONTRACT DOCUMENTS

ARTICLE 1 THE WORK OF THIS WORK ORDER

The Contractor shall execute the Work described in the Contract Documents enumerated in Article 7 of this Work Order, and any modifications issued after execution of this Work Order, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

- ☐ [« »] The date of this Work Order.
- ☐ [« »] A date set forth in a notice to proceed issued by the Owner.
- ☐ [« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)
- ☐ [« »]

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

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

§ 2.3 Substantial Completion

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

- ☐ [« »] Not later than « » (« ») calendar days from the date of commencement of the Work.
- ☐ [« »] By the following date: « »

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

Portion of Work	Substantial Completion Date

§ 2.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 2.3, liquidated damages, if any, shall be assessed as set forth in Section 3.6.

ARTICLE 3 CONTRACT SUM

§ 3.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:

(Check the appropriate box.)

- ☐ Stipulated Sum, in accordance with Section 3.2 below
- ☐ Cost of the Work plus the Contractor's Fee, in accordance with Section 3.3 below
- ☐ Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 3.4 below
- ☐ Other, in accordance with Section 3.5 below

(Based on the selection above, complete Section 3.2, 3.3, 3.4 or 3.5 below.)

§ 3.2 Stipulated Sum

§ 3.2.1 The Stipulated Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

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

(State the numbers or other identification of accepted alternates. If the Owner is permitted to accept other alternates subsequent to the execution of this Work Order, attach a schedule of such other alternates showing the change in the Stipulated Sum for each and the deadline by which the alternate must be accepted.)

§ 3.2.3 Unit prices, if any:

(Identify the item and state the unit price and any applicable quantity limitations.)

Item	Units and Limitations	Price per Unit (\$0.00)

§ 3.2.4 Allowances, if any, included in the Stipulated Sum:

(Identify each allowance.)

Item	Price

§ 3.3 Cost of the Work plus Contractor's Fee

§ 3.3.1 The Cost of the Work is as defined in AIA Document A121™– 2018 Exhibit A, Determination of the Cost of the Work.

§ 3.3.1.1 The following costs are subject to the Owner's prior approval:

§ 3.3.2 The Contractor's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the fee for changes in the Work.)

§ 3.4 Cost of the Work plus Contractor's Fee with a Guaranteed Maximum Price

§ 3.4.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.4.1.1 The following costs are subject to the Owner's prior approval:

« »

§ 3.4.2 The Contractor's Fee:

(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the fee for changes in the Work.)

« »

§ 3.4.3 Guaranteed Maximum Price

§ 3.4.3.1 The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed « » (\$ « »), subject to additions and deductions by changes in the Work as provided in the Contract Documents. This maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner. *(Insert specific provisions if the Contractor is to participate in any savings.)*

« »

§ 3.4.3.2 The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

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

« »

§ 3.4.3.3 Unit Prices, if any:

(Identify the item and state the unit price and any applicable quantity limitations.)

Item	Units and Limitations	Price Per Unit (\$0.00)

§ 3.4.3.4 Allowances, if any, included in the Guaranteed Maximum Price:

(Identify each allowance.)

Item	Price

§ 3.4.3.5 Assumptions, if any, on which the Guaranteed Maximum Price is based:

« »

§ 3.4.3.6 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.

§ 3.4.3.7 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in Section 3.4.3.5. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions contained in Section 3.4.3.5 and the revised Contract Documents.

§ 3.5 Other

§ 3.5.1 The Contract Sum shall be determined in accordance with the following:
(Insert a description of how the Contract Sum will be determined.)

« »

§ 3.6 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

« »

ARTICLE 4 PAYMENTS

§ 4.1 Payments shall be in accordance with Article 3 of the Master Agreement, except as indicated below:

(Indicate all payment terms that differ from those set forth in the Master Agreement, such as period covered by each Application for Payment or date upon which each Application for Payment is due.)

« »

§ 4.2 Retainage will be withheld in accordance with Article 3 of the Master Agreement, except as indicated below:

(Indicate all retainage terms that differ from those set forth in the Master Agreement, such as retainage amount, items not subject to retainage, terms for reduction, or limitation of retainage.)

« »

ARTICLE 5 INSURANCE AND BONDS

§ 5.1 Insurance shall be in accordance with Article 15 of the Master Agreement, except as indicated below:

(Insert any insurance requirements that differ from those stated in the Master Agreement, such as coverage types, coverage limits, and durations for professional liability or other coverages.)

« »

§ 5.2 In addition to insurance requirements in the Master Agreement, the Contractor shall carry the following types of insurance.

(List below any other insurance coverage to be provided by the Contractor, not otherwise set forth in the Master Agreement, and any applicable limits.)

Coverage	Limits

§ 5.3 Pursuant to section 15.1.7 of the Master Agreement, 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.

§ 5.4 Pursuant to section 15.1.8 of the Master Agreement, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ 5.5 Pursuant to section 15.1.9 of the Master Agreement, the Contractor shall procure a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ 5.6 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	

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 Work Order.

ARTICLE 6 PARTY REPRESENTATIVES

§ 6.1 The Owner identifies the following representative in accordance with Section 1.4.1 of the Master Agreement:
(List name, address, and other information.)

<< >>
<< >>
<< >>
<< >>
<< >>
<< >>

§ 6.2 The Contractor identifies the following representative in accordance with Section 1.5.1 of the Master Agreement:
(List name, address, and other information.)

<< >>
<< >>
<< >>
<< >>
<< >>
<< >>

ARTICLE 7 ENUMERATION OF CONTRACT DOCUMENTS

§ 7.1 The Contract Documents are defined in Section 5.2 of the Master Agreement and, except for Modifications issued after execution of this Work Order, are enumerated in the sections below.

§ 7.1.1 This Work Order

§ 7.1.2 The Master Agreement

§ 7.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 7.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Work Order.)

<< >>

Section	Title	Date	Pages

§ 7.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Work Order.)

<< >>

Number	Title	Date

§ 7.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are enumerated in this Article 5.

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

(List here any additional documents that are intended to form part of the Contract Documents.)

« »

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

OWNER *(Signature)*

« »« »

(Printed name and title)

CONTRACTOR *(Signature)*

« »« »

(Printed name and title)

OUR LADY OF THE LAKE REGIONAL MEDICAL CENTER			
Policy Manual:	Environment of Care	Section:	Fire Prevention
Title:	Interim Life Safety Measures (ILSM)	Policy Reference #:	ECLS001
		Supersedes #:	
Date of Origination:	July 1997	Review Date:	11/01/2017
Revision Date:	11/01/2017		

PURPOSE:

When building code deficiencies are identified and cannot be immediately corrected or during renovation or construction activities, the safety of patients, staff, and visitors coming to the hospital's facilities is diminished. Our Lady of the Lake Regional Medical Center (OLOL) will proactively identify administrative actions to be taken if these scenarios arise.

DEFINITIONS:

Interim Life Safety Measures (ILSMs) are a series of life safety actions intended to temporarily compensate for significant hazards posed by existing National Fire Protection Association (NFPA) 101, 2012, Life Safety Code (LSC) deficiencies identified when performing preventative maintenance of life safety systems, during construction or renovation activities, and when life safety code deficiencies cannot be immediately corrected.

POLICY:

OLOL requires implementation of Interim Life Safety Measures in or adjacent to all construction areas and throughout buildings with existing LSC deficiencies. To ensure a high level of safety during all construction activities and to meet the provisions of the Interim Life Safety Measures as set forth by the Joint Commission. ILSM applies to all staff, including construction workers.

PROCEDURES:

ILSMs are intended to provide a level of life safety when there are deficiencies to existing elements of fire safety. Activities reviewed will become ILSM activities if the activity in some manner impairs the following:

1. The exiting requirement(s),
2. Fire detection and suppression systems,
3. Fire / smoke barriers for greater than the supervised work shift, and/or
4. Increased fire hazards.

Actions to be taken will be based on Interim Life Safety Measures Application Matrix.

1. Whenever a construction or renovation project at OLOL or Affiliates receives approval, a Life Safety Assessment (LSA) will be completed with an analysis of potential hazards as well as mitigation procedures and other requirement(s) determined to be put in place, indicating whether Interim Life Safety Measures (ILSM), if any, will occur.

2. Once the Life Safety Assessment (LSA) has been completed, the Safety Officer in coordination with the Plant Services Director or designee will determine what is necessary to temporarily compensate for any life safety hazards posed to buildings and occupants. A copy of the LSA will be maintained in the Plant Services Office. The evaluation will include:
 - a. Code Deficiencies
 - b. Construction related deficiencies.
 - c. Maintenance or repairs.
3. Any changes to the plan will be communicated immediately to the Safety Officer and Plant Services Director and a new ILSM plan issued.
4. When ILSM is required, Plant Services will develop the work plan and communicate the ILSM requirements needed to the appropriate department leadership or designee and contractors, and will verify that the ILSM measures are properly implemented.
5. If the fire alarm system is out of service more than 4 hours in a 24-hour period or sprinkler system is out of service more than 10 hours in a 24-hour period, the fire department and/or other emergency response groups will be notified. The notification and fire watch times will be documented on the Interim Life Safety Measure form. Fire Watch procedure per Louisiana State Fire Marshals office
6. A risk assessment will be completed for partial system shutdowns to determine if a Fire Watch or a Daily Fire Inspection should be used.
7. Daily inspections will be performed on the means of egress in any area undergoing construction, repair, or improvement to ensure egress is free of obstructions. The activity will be documented.
8. As determined by the LSA:
 - a. Temporary construction partitions may be used
 - b. Increased surveillance of area will be provided
 - c. Additional fire-fighting equipment and training provided to compensate for impaired structural or compartmental fire safety features will be provided, as needed
 - d. Staff will be educated to promote awareness of the building deficiencies, construction hazards, and temporary measures implemented in the affected areas
 - e. Storage, housekeeping, and debris-removal practices are observed
 - f. During ILSM the facility will conduct one (1) fire drill per shift per quarter
 - g. An ILSM Posting will be filled out and issued to the affected departments and posted in the area(s) affected
 - h. Alternate routes of egress will be attached and posted as needed to the ILSM Posting
 - i. Monthly testing on temporary systems will be performed and documented
9. ILSM Documentation will be maintained in Plant Services and communicated to the EOC Committee.

REFERENCES:

Joint Commission, Life Safety.01.02.01 Standards

National Fire Protection Association (NFPA) 101-2012: 9.6.1.6; 9.7.6

National Fire Protection Association (NFPA) 25-2011: 15.5.2

SUPPORTING DOCUMENTS/ATTACHMENTS

ECLS001A Attachment – Requirements for a Daily Fire Inspection

ECLS001B Attachment – Requirements for a Temporary Fire Watch

ECLS001C Interim Life Safety Measures Matrix

Facility/Building Name

Date

Documenting for Regulatory Code

LS	EP
LS.01.02.01	1-15

Project Name:	Project/ Work Order No.	Entity:
Project Implementation Date:	ILSM Evaluation Date:	Estimated Completion Date:
Project Manager:	Telephone:	Project Manager Mobile #

	Criteria	Points	Score
1	Job Length		
	Greater than 3 months	20	
	From 1 to 3 months	15	
	Less than 1 month	10	
	Less than 1 week	0	
3	Hazards of Work Activity Materials		
	Unprotected flammable	20	
	Excessive combustible	15	
	Low Hazards Only	0	
5	Fire / Smoke Separations		
	Missing	25	
	Significant Compromise	15	
	Minor Penetrations	10	
	None	0	
7	Impact on Exit Access (Corridors)		
	Redirect / reroute exit	25	
	Redirected exits not visible	15	
	Exit access width reduced	10	
	None	0	
9	Temp Work Activity Partitions		
	Multiple partitions in zone	20	
	One partition	15	
	Barricades	10	
	No partition necessary	0	
11	Access to Emergency Department & Building Exterior		
	Emergency Dept. blocked	25	
	Building exit blocked > 50'	20	
	Building exit blocked < 50'	10	
	None	0	

	Criteria	Points	Score
2	Impact on Patient Care		
	Work is in patient area	20	
	Near ambulatory patients	15	
	Near visitor / staff areas	10	
	Near staff only	0	
4	Hazards of Work Activity Methods		
	Open flame	20	
	Heat producing / elec welding	15	
	Low Hazards Only	10	
6	Impact on Exiting (Building Exit)		
	Exit blocked	25	
	Exit obstructed	20	
	Exit penetrated	15	
	None	0	
8	Impact on Fire Alarms/ Sprinkler System		
	Multiple zones	20	
	One zone	15	
	In zone - no working system	5	
	None	0	
10	Doors		
	Excessive fire door deficiencies	20	
	Excessive smoke door deficiency	10	
	Patient Doors	5	
	None	0	

Note:

- 1) A score of 100 point or more on this Life Safety Assessment form will require a more detailed review and evaluation by the Project Manager and may result in implementation of ILSM.
- 2) A score greater than 0 in Criteria Sections 5, 6, 7, or 8 will require an ILSM Evaluation regardless of total points scored.

Preliminary Life Safety Assessment	
Sum of 5, 6, 7, 8	
Impact on egress?	
ILSM Required?	

(Signature) Project Manager:

(Signature) Contractor Representative:

(Signature) Safety Officer:



ILSM Evaluation Record

Facility Name

Documenting for Regulatory Code	
LS	EP
LS.01.02.01	1-15

Date

Specific ILSMs to Implement

Project Name:	Project / Work Order No.	Entity:
Project Implementation Date:	ILSM Evaluation Date:	Estimated Completion Date:
Project Manager	Telephone:	Project Manager Mobile #

BELOW WRITE YOUR DETERMINATION OF REQUIRED MEASURES AND HOW YOU WILL IMPLEMENT THEM:

I am using the recommended measures listed below in row(s) _____

Please list any additional measures you are taking below:

Signatures:

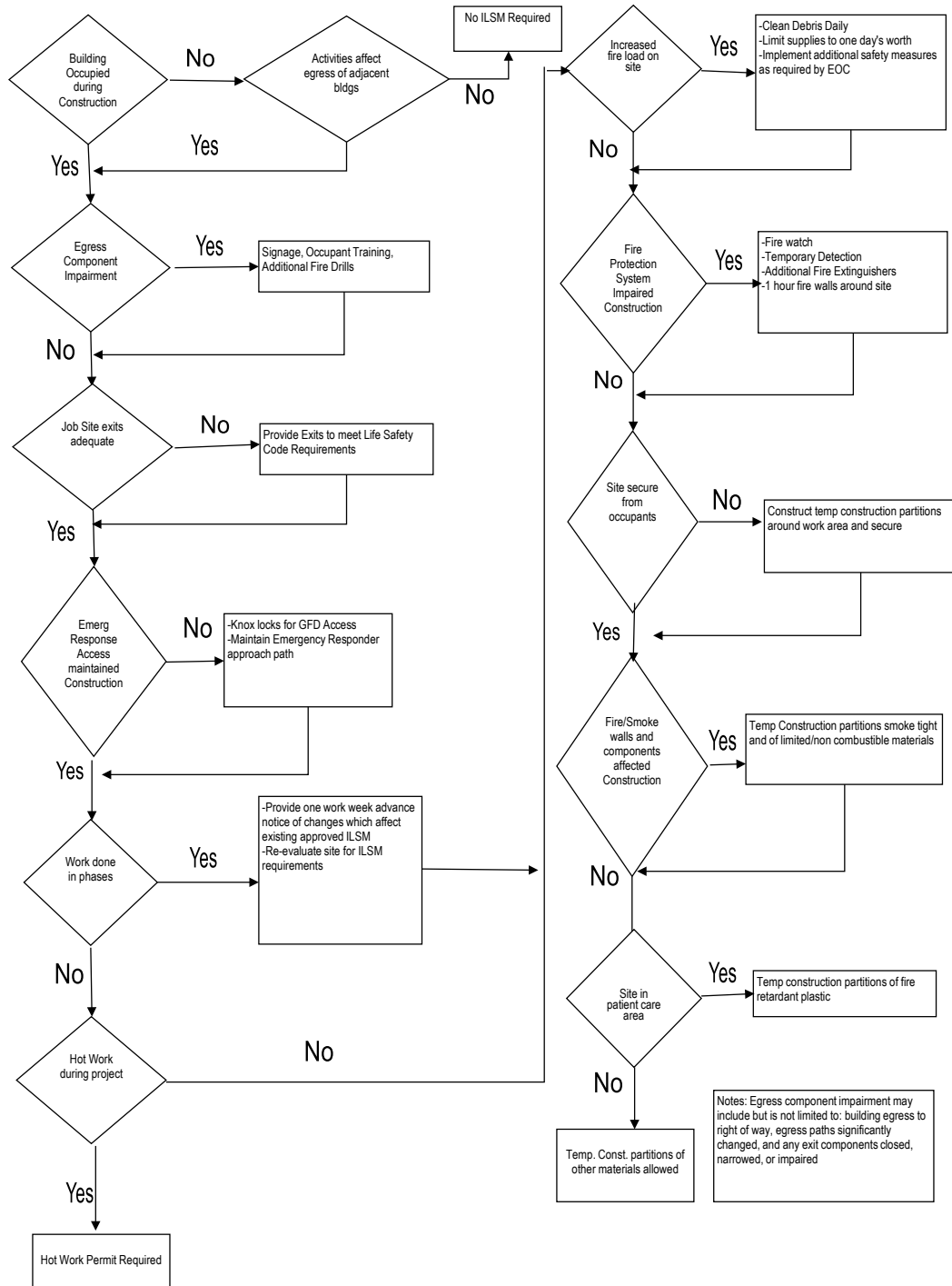
Life Safety Representative	Date
Project Manager	Date
Contractor Representative	Date

Interim Life Safety Measures (ILSM) Matrix		1. Emergency Forces Notification	2. Posting Signage of Alternate Exits	3. Implement ILSM Procedure	4. Ensuring Egress (Daily basis of areas affected)	5. Providing temporary but equivalent fire alarm and detection	6. Additional Fire Fighting Equipment	7. Temporary Construction Barriers	8. Increased Hazard Surveillance	9. Controlling Combustibles	10. Additional training of Personnel on use of fire-fighting equipment	11. Conducting one (1) additional Fire Drill Per Shift	12. Inspects temporary systems monthly	13. Provide Life Safety Training to affected areas.	14 Training to compensate for structural or compartmental fire safety features	15. Emergency Forces Clean Access	16. Prohibits Smoking	17. Other
Code Deficiencies																		
1	Excessive fire/smoke door deficiencies			X					X	X							X	
2	Lacking a code complying smoke or fire barrier			X			X		X	X		X		X	X	X	X	
3	Fire exit stairs discharge not properly maintained	X		X	X							X		X	X	X	X	
4	Excessive travel distance to an approved exit		X	X	X				X	X		X			X		X	
5	Lack of two remote exits			X	X		X		X	X		X			X		X	
6	Non-conforming building construction type			X			X		X	X				X	X		X	
7	Improperly protected vertical openings			X					X	X				X	X		X	
8	Large penetrations in fire barriers			X			X		X	X							X	
9	Corridor walls do not extend to the structure			X					X	X					X		X	
10	Hazardous areas not properly protected			X					X	X							X	
Construction Related Issues																		
11	Blocking off an approved exit		X	X	X					X				X			X	
12	Rerouting of traffic to the emergency room		X											X		X	X	
13	Major renovation of an occupied floor			X	X		X	X	X	X		X					X	
14	Replacing fire alarm system (Out of service) (4 hours)	X		X		X	X		X	X	X	X	X	X			X	
15	Installing sprinkler system (Out of service) (10 hours)	X		X			X		X	X	X	X					X	
16	Significantly modifying smoke or fire barrier walls / keeping fire door open			X				X	X	X		X		X	X		X	
17	Adding an addition to an existing structure	X		X	X		X	X	X	X		X		X		X	X	
Maintenance & Testing																		
18	Taking a fire alarm system out of service (4 hours)	X		X		X	X			X	X			x			X	
19	Taking a sprinkler system out of service (10 hours)	X		X			X			X	X			x			X	
20	Disconnecting multiple alarm devices within smoke			X			X		X	X	X	X					X	
21	Hot Work (more than 24 hours)			X	X		X		X	X							X	
22	Fire/ Smoke Damper Deficiencies			x						x							x	
23	Fire Rated (door) assemblies not rated			x						x							x	
24	Relocate O2 Tank/ Alarm Systems/ Valves			x						x							x	
Evaluation Results:																		
1) Interim Life Safety Measures (ILSMs) are not required because: _____ no life safety features will be compromised. (Explanation Attached)		COMMENTS:																
2) Interim Life Safety Measures (ILSMs) are required by this project: _____ ILSM Implementation Record is attached.																		



Date

1-15



Interim Life Safety Measures (ILSM) Checklist

Facility Name:

Project/Work Order Number:

Project Title:

Documenting for Regulatory Code	
LS	LS.01.02.01
EP	2 - 14

Daily Inspection Items

For Items checked "FAIL", attach a description of the deficiency and corrective action steps taken

	Mon		Tues		Wed		Thurs		Fri		Sat		Sun	
	Date: _____		Date: _____		Date: _____		Date: _____		Date: _____		Date: _____		Date: _____	
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
All exits and egress are unobstructed and useable, including the Work Activity Area.														
Alternate Routes are identified, if required.														
All personnel have training if alternate exits have been designated.														
Work Activity workers know the means of egress.														
The means of egress in the Work Activity area are inspected daily.														
There is free and unobstructed means to access emergency services.														
Fire Alarm Detection and Suppression System will both remain in full service.														
A temporary, but equivalent, system is provided when fire system is impaired and is documented that it is inspected and tested monthly.														
Before the fire alarm systems are taken out of service, plans are taken to compensate, including notification of appropriate authority having jurisdiction (local fire dept., insurance carrier, etc.).														
Work Activity area is clean and orderly.														
Temporary Work Activity partitions are smoke tight and built of noncombustible or limited combustible material.														
Work Activity area is properly restricted from the rest of the facility with appropriate signage.														

Project Title:

Daily Inspection Items	Mon		Tues		Wed		Thurs		Fri		Sat		Sun	
For Items checked "FAIL", attach a description of the deficiency and corrective action steps taken	Date: _____		Date: _____		Date: _____		Date: _____		Date: _____		Date: _____		Date: _____	
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Access to Work Activity area is limited to authorized personnel.														
Smoking is prohibited in the Work Activity area and adjacent areas.														
Storage, housekeeping, and debris removal practices are enforced to reduce the flammability and combustibility fire load of the building to the minimum necessary to conduct daily operation.														
Additional fire fighting equipment and in-use training are provided to personnel.														
Additional Fire Drills are required by ILSM Policy														
Facility wide safety education programs are conducted to ensure awareness of any Life Safety Code issue deficiencies, Work Activity Hazards, and Interim Life Safety Measures are in place.														
The need for Daily Fire Inspection or Fire Watch is established and personnel instructed according to the nature of the job and the work in progress.														
OLOL Representative/Designee Signature														



OUR LADY
OF THE LAKE
REGIONAL MEDICAL CENTER

Monthly ILSM Inspection Sheet

Facility Name

Month/Year

Documenting for Regulatory Code

LS

EP

LS.01.02.01

1-15

Inspector	Date	Comments
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

ILSM Notification Exit Closure

Effective **(Date)** _____

(Location) _____ has been
closed to complete the **(Name of Project)**

_____.

The exit will be closed for approximately **(Time Frame)**

_____.

During this time period the area will be under Interim
Life safety Measures **(ILSM)**.

In the event that evacuation of the building becomes
necessary please be aware of your alternate exits.

(Alternate area)

_____.

If you have any questions or concerns that pertain to
these measures please, do not hesitate to contact:

_____. In the event of an emergency
please have _____ paged through the
Plant Operations Dispatcher at 225-765-8292.

ILSM Notification

This construction project is under the Interim Life Safety Measures (**ILSM**). If you have any questions or comments that pertain to the measures please do not hesitate to call _____ at _____. In the event of an emergency, please have _____ paged through Plant Services at 225-765-8292.

REQUIREMENTS FOR DAILY FIRE INSPECTION

In the event that a required fire alarm out of service more than 4 hours /sprinkler system is out of service more than 10 hours and is determined to be not in proper working order the following actions shall be taken by the facility or the building shall be vacated:

1. Notify the State Fire Marshal District Office, the local fire department and all facility personnel, in writing, that the fire alarm/sprinkler system is not operational.
2. Establish a Daily Fire Inspection to be completed by individuals
3. Provide personnel with a means of identifying themselves as authorized representatives of the facility.
4. Each route to be covered by personnel shall be designated by the facility.
5. The route shall be explicitly defined to ensure that the personnel patrols the correct area.
6. The personnel assigned to each route shall be provided with instructions, all details regarding the route, and the functions to be carried out in covering the route.
7. Personnel shall make rounds once (1) daily. **During the rounds, the personnel shall make a thorough inspection of all buildings or spaces including concealed areas, such as attics, unoccupied storage areas, etc.** Personnel shall sign a log sheet maintained in the facility main office or other location approved by this office. **Log sheet shall state time and date of each individual round.**
8. Procedures shall be established for orderly conduct of the operations at the property, including procedures for fire loss prevention both by employees of the property protected and by outside contractors, and the prompt reporting of any fires discovered by calling the public fire department and the fire brigade.

Guidelines (Cont.)

9. Each facility shall establish programs for personnel to ensure they are familiar with the property being protected, including:
 - (a) All buildings, occupancies, and hazards.
 - (b) Fixed fire protection systems.
 - (c) Manual and automatic detection and alarm systems.
 - (d) Portable fire protection equipment.
 - (e) Emergency shutdown procedures and equipment for which they are responsible.
 - (f) The facility emergency action plan.
10. Each facility shall ensure that personnel are familiar with the site- specific emergency plans for dealing with fires and other emergencies.
11. Each facility shall ensure that personnel are familiar with the procedures to follow in the recognition and reporting of an emergency, including:
 - (a) When and how to use radio equipment, telephone, and private or public alarm boxes to summon aid.
 - (b) How to notify the fire brigade, the municipal fire department, and other emergency response organizations.
 - (c) The personnel to be contacted.
12. Personnel shall be provided with a means for continuous communication (i.e., two-way radio; walkie-talkies; etc.) with a constantly attended location such as the administrative office where a public address announcement can be made throughout all buildings in the event of an emergency.**
13. Each facility manager/administrator shall ensure that:
 - (a) Personnel are not permitted to change the time record charts.
 - (b) The changing and review of time record charts is done by the manager/administrator or the manager/administrator's responsible designee.
 - (c) Time record charts of personnel are promptly reviewed.
 - (d) Files are maintained for review by representatives of any authority having jurisdiction.
 - (e) All irregularities are investigated, recorded, and corrective action is taken.

Fire Watch Guidelines (Cont.)

14. A continuously updated directory of names, telephone numbers, and other information to assist in making emergency calls shall be kept at the facilities administrative office. This directory shall include the telephone numbers of key facility personnel to be notified in an emergency, fire, police and emergency medical service departments, and other outside agencies needed in an emergency.

PLEASE BE ADVISED THAT THE DURATION OF THE FIRE INSPECTIONS WILL BE DETERMINED ON A CASE BY CASE BASIS.

*It shall be the responsibility of management to ensure that personnel are capable of performing all functions as defined in this document.

Start Date _____ **End Date** _____ **Location:** _____

Page_____ of _____

REQUIREMENTS FOR TEMPORARY FIRE WATCH

In the event that a required fire alarm out of service more than 4 hours /sprinkler system is out of service more than 10 hours and is determined to be not in proper working order the following actions shall be taken by the facility or the building shall be vacated:

1. Notify the State Fire Marshal District Office, the local fire department and all facility personnel, in writing, that the fire alarm/sprinkler system is not operational.
2. Establish a temporary fire watch by individuals who are **dedicated solely to fire watch duty.**
3. Provide fire watch personnel with a means of identifying themselves as authorized representatives of the facility.
4. Each route to be covered by fire watch personnel shall be designated by the facility.
5. The route shall be explicitly defined to ensure that the fire watch personnel patrols the correct area.
6. The fire watch personnel assigned to each route shall be provided with instructions, all details regarding the route, and the functions to be carried out in covering the route.
7. Fire watch personnel shall make rounds one (1) hour intervals. When operations in the property normally are suspended, officers shall make rounds hourly. **During the rounds, the fire watch personnel shall make a thorough inspection of all buildings or spaces including concealed areas, such as attics, unoccupied storage areas, etc.** Fire watch personnel shall sign a log sheet maintained in the facility main office or other location approved by this office or fire department. **Log sheet shall state begin time and end time of each individual round.**
8. Procedures shall be established for orderly conduct of the operations at the property, including procedures for fire loss prevention both by employees of the property protected and by outside contractors, and the prompt reporting of any fires discovered by calling the public fire department and the fire brigade of the proper one (1) hour intervals ty (if available on the shift).

Fire Watch Guidelines (Cont.)

9. Each facility shall establish programs for fire watch personnel to ensure they are familiar with the property being protected, including:
 - (a) All buildings, occupancies, and hazards.
 - (b) Fixed fire protection systems.
 - (c) Manual and automatic detection and alarm systems.
 - (d) Portable fire protection equipment.
 - (e) Emergency shutdown procedures and equipment for which they are responsible.
 - (f) The facility emergency action plan.
10. Each facility shall ensure that fire watch personnel are familiar with the site-specific emergency plans for dealing with fires and other emergencies.
11. Each facility shall ensure that fire watch personnel are familiar with the procedures to follow in the recognition and reporting of an emergency, including:
 - (a) When and how to use radio equipment, telephone, and private or public alarm boxes to summon aid.
 - (b) How to notify the fire brigade, the municipal fire department, and other emergency response organizations.
 - (c) The personnel to be contacted.
12. Fire watch personnel shall be provided with a means for continuous communication (i.e., two-way radio; walkie-talkies; etc.) with a constantly attended location such as the administrative office where a public address announcement can be made throughout all buildings in the event of an emergency.**
13. Each facility manager/administrator shall ensure that:
 - (a) Fire watch personnel are not permitted to change the time record charts.
 - (b) The changing and review of time record charts is done by the manager/administrator or the manager/administrator's responsible designee.
 - (c) Time record charts of fire watch personnel are promptly reviewed.
 - (d) Files are maintained for review by representatives of any authority having jurisdiction.
 - (e) All irregularities are investigated, recorded, and corrective action is taken.

Fire Watch Guidelines (Cont.)

14. A continuously updated directory of names, telephone numbers, and other information to assist in making emergency calls shall be kept at the facilities administrative office. This directory shall include the telephone numbers of key facility personnel to be notified in an emergency, fire, police and emergency medical service departments, and other outside agencies needed in an emergency.

**PLEASE BE ADVISED THAT THE DURATION OF THE
TEMPORARY FIRE WATCH WILL BE DETERMINED ON A CASE BY
CASE BASIS.**

*It shall be the responsibility of management to ensure that fire watch personnel are capable of performing all functions of a fire watch as defined in this document.

Note: Local ordinances may require the fire department having jurisdiction to conduct the fire watch; however, the fire watch guidelines, as stated in this document, shall be implemented.

**Buildings or areas of the building without public address systems, there shall be a sufficient number of fire watch personnel to initiate evacuation procedures throughout the building in an orderly manner.

AREA: _____

Our Lady of the Lake Hospital

Facility_____Page _____ of _____

Interim Life Safety Measures (ILSM) Education/ Training Sign-in

Department: _____

Floor _____

Date ILSM Started _____ **Date Ended** _____

[illegible]

Hello, my name is _____. I'm here with Plant Services to conduct your training for the Interim Life Safety Measures that effects your work area.

During this training we will be going over changes of egress. If any of your exits are blocked, signage will be posted showing directions to alternative exits in the area. Should medical gas valves be blocked- alternative routes to access them will be posted with signage. We will also go over the proper fire response in case of a fire, including fire extinguisher usage. There will also be 3 additional Fire Drills, one per shift per quarter in this area while the ILSM is in place. All things that are being implemented are as required by the Hospitals ILSM Policy.

If there are any questions please feel free to ask.

Thank You

The Commissioning and Decommissioning of Life Safety Items During Construction/Renovation

Add the quantity in the correct box then provide the locations and/or unique identifiers below:

Life Safety Items	# Added	# Removed	# Relocated	# Replaced
Alcohol-Based Hand-Rub Dispensers				
Eyewash Station				
Fire-Rated Ceiling Tiles				
Life Safety Plans				
Air and Environment:				
• Humidity Monitor				
• Isolation Room				
• Negative Pressure				
• Positive Pressure				
• Temperature Monitor				
Doors:				
• Badge Access				
• Delayed Egress				
• Key lock				
• Magnetic lock				
• Non smoke or fire-rated doors				
• Positive Latching/Hardware				
• Smoke doors/Fire doors				
Electrical:				
• Automatic Transfer Switch				
• Outlets				
• Panels				
Emergency Lighting:				
• Emergency Backup Lights				
• Exit Signs				
Fire Safety:				
• Audio				
• Data/MRI Suppression System				
• Fire & Smoke Dampers				
• Heat Detectors				
• Kitchen Hood System				
• Manual Pull Station				
• Portable Fire Extinguishers				
• Smoke Detectors				
• Sprinkler System				
• Strobe				
Hazardous Area:				
• Clean Supply Room				
• Soiled Linen or				
• Other: _____				
Shutoff Valve:				
• Medical Gas				
• Water				
Vertical Openings:				
• Elevator Shaft				
• Laundry Chute				

• Light shaft				
• Stairway				
• Ventilation shaft				
Walls:				
• Fire barrier				
• Occupancy separation				
• Smoke barrier				
• Smoke partition				

Life Safety Item Changed:		Original Number		New Number	

List locations and unique identifiers:			
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	

Life Safety Item Changed:		Original Number		New Number	

List locations and unique identifiers:			
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	

Life Safety Item Changed:		Original Number		New Number	

List locations and unique identifiers:			
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	

Life Safety Item Changed:		Original Number		New Number	

List locations and unique identifiers:			
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	
Location:		Unique ID:	

Pre-Construction Risk Assessment (PCRA)

Project Name:	Project Location:
OLOL Project #:	Architect:
Project Manager/Designee:	Contractor:
Project Description:	Date PCRA initiated:

Directions: Answer all questions including page 2. Do not leave blank, use Yes, No, N/A or Not applicable.

YES	NO	
☐	☐	A. Will construction directly affect patient care environment or high risk areas? List all spaces that will be affected. Spaces adjacent to, above and below job site must be considered. Risk Identified: _____ Resolution, Brief Description, Accountable Crew / Unit: _____
☐	☐	B. Will HVAC systems be affected by the construction i.e. air intakes, exhaust systems, air handlers? List each system affected. Risk Identified: _____ Resolution, Brief Description, Accountable Crew / Unit: _____
☐	☐	C. Are Utility Shut Downs Required? Check all that apply. Must be coordinated with contractor, Facilities Services, affected departments and hospital administration in order to minimize disruption to operations. ☐ HVAC ☐ Sanitary ☐ Steam ☐ Medical Gas ☐ Electric ☐ Hot Work Permit ☐ Hot/Cold Domestic Water ☐ Other (Specify): i.e. Lock-out/Tag-out _____ Risk Identified: _____ Resolution, Brief Description, Accountable Crew / Unit: _____
☐	☐	D. Does the construction area contain any environmental hazards? List environmental hazards requiring special attention. ☐ Asbestos ☐ Chemicals (Specify) _____ ☐ Other (Specify) _____ Risk Identified: _____ Resolution, Brief Description, Accountable Crew / Unit: _____
☐	☐	E. Does the project require more than 2 ceiling tiles at a time to be removed? If Yes, include Above Ceiling Permit.
If any of the above questions A-E were answered "yes", an ICRA must be completed.		
☐	☐	F. Will construction activities generate noise and vibration that will disrupt occupants adjacent to, above or below the work site? List all affected areas, notification must include administration. How will work be managed to minimize disruption? Risk Identified: _____ Resolution, Brief Description, Accountable Crew / Unit: _____
☐	☐	G. Does project require hard hats?
☐	☐	H. Does this project impact an existing means of egress, exits, fire alarm systems, or fire suppression systems? If yes, complete an Interim Life Safety Tool (ILSM).
☐	☐	I. Are there other factors or safety concerns that may prompt the need for an ICRA and/or ILSM? Please explain: Risk Identified: _____ Resolution, Brief Description, Accountable Crew / Unit: _____

Notification and copy sent to the following:							
YES	N/A	YES	N/A	YES	N/A	YES	N/A
☐	☐	☐	☐	☐	☐	☐	☐
Dept Director		Infection Control		Construction Manager		Information System	
Safety Officer		Life Safety		Senior Administrator			

Continue to page 2 and share other additional information, interventions and plans related to this project that may affect the care, treatment or services of patients and employees of OLOLRMC.

Reviewed by: _____	Date: _____
_____	_____
_____	_____
_____	_____

TJC Standard EC 02.06.05 states that space must be managed during demolition, renovation or new construction to reduce risk to those in the organization. This form addresses Element of Performance 2. An ILSM must be completed to comply with Element of Performance 3 (See *ILSM for Construction and Renovation Projects* Form). An ICRA must be completed to comply with Element of Performance 3 (See *Infection Control Risk Assessment and Permit* Form).

Project Name:	LOL Project #:
Directions: Provide brief description of risk identified and resolution. Use space below.	

YES	NO					
☐	☐	J. Pathway and process for tools, materials, deliveries: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 5px; vertical-align: top;"><u>Risk Identified:</u></td> <td style="padding: 5px; vertical-align: top;"><u>Resolution, Brief Description, Accountable Crew / Unit:</u></td> </tr> <tr> <td style="height: 100px;"></td> <td></td> </tr> </table>	<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>		
<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>					
☐	☐	K. Pathway and process for debris removal: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 5px; vertical-align: top;"><u>Risk Identified:</u></td> <td style="padding: 5px; vertical-align: top;"><u>Resolution, Brief Description, Accountable Crew / Unit:</u></td> </tr> <tr> <td style="height: 100px;"></td> <td></td> </tr> </table>	<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>		
<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>					
☐	☐	L. Other spaces affected not listed in line item "A" <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 5px; vertical-align: top;"><u>Risk Identified:</u></td> <td style="padding: 5px; vertical-align: top;"><u>Resolution, Brief Description, Accountable Crew / Unit:</u></td> </tr> <tr> <td style="height: 100px;"></td> <td></td> </tr> </table>	<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>		
<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>					
☐	☐	M. Are there any other circumstances that may affect care, treatment and services that has not been addressed above? <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 5px; vertical-align: top;"><u>Risk Identified:</u></td> <td style="padding: 5px; vertical-align: top;"><u>Resolution, Brief Description, Accountable Crew / Unit:</u></td> </tr> <tr> <td style="height: 100px;"></td> <td></td> </tr> </table>	<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>		
<u>Risk Identified:</u>	<u>Resolution, Brief Description, Accountable Crew / Unit:</u>					

Contractor PM: _____	Date: _____
Plant Services: _____	Date: _____
Infection Prevention: _____	Date: _____

HOT WORK PERMIT FOR CUTTING AND WELDING WITH PORTABLE GAS OR ARC EQUIPMENT

Date _____ Building _____
Dept / Floor _____ Description of work _____
Special precautions _____ Fire Watch Required _____

The location where this work is to be done has been examined, necessary precautions taken, and permission is granted for this work. (See other side.)

Permit expires
Signed
(Individual responsible for authorizing welding and cutting)

Time started Completed

FINAL CHECK

Work area and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite side of wall(s) were inspected 30 minutes after the work was completed and were found firesafe.

Signed.....(Supervisor or Fire Watcher)

ATTENTION

Before approving any cutting and welding permit, the fire safety supervisor or appointee shall inspect the work area and confirm that precautions have been taken to prevent fire in accordance with NFPA 51B.

PRECAUTIONS

- ☐ Sprinklers in service
- ☐ Cutting and welding equipment in good repair

WITHIN 35 FT OF WORK

- ☐ Floors swept clean of combustibles
- ☐ Combustible floors wet down, covered with damp sand, metal or other shields.
- ☐ No combustible material or flammable liquids
- ☐ Combustibles and flammable liquids protected with covers, guards or metal shields
- ☐ All wall and floor openings covered
- ☐ Covers suspended beneath work to collect sparks

WORK ON WALLS OR CEILINGS

- ☐ Construction noncombustible and without combustible covering
- ☐ Combustibles moved away from opposite side of wall

WORK ON ENCLOSED EQUIPMENT

- (Tanks, containers, ducts, dust collectors, etc.)
- ☐ Equipment cleaned of all combustibles
 - ☐ Containers purged of flammable vapors

FIRE WATCH

- ☐ To be provided during and 30 minutes after operation
- ☐ Supplied with extinguisher and small hose
- ☐ Trained in use of equipment and in sounding fire alarm

FINAL CHECK

- ☐ To be made 30 minutes after completion of any operation unless fire watch is provided.

Signed.....(Supervisor)

SERVICE SHUT-DOWN CONFIRMATION

OWNER
ARCHITECT
CONTRACTOR
FIELD

DATE_____

OWNER **Our Lady of the Lake Regional Medical Center**
5000 Hennessy Blvd.
Baton Rouge, Louisiana

CONTRACTOR

THE CONTRACTOR HEREBY REQUESTS FROM THE OWNER TO TEMPORARILY SHUT DOWN MECHANICAL AND/OR ELECTRICAL SYSTEMS LISTED BELOW FOR THE STIPULATED TIME SPANS.

Service to be shut down_____

Area to be affected by shut-down_____

Date of shut-down requested_____

Beginning time of shut-down_____

Minimum anticipated time required_____

Maximum anticipated time required_____

Special precaution, if any:_____

Special turn-on or start-up requirements:_____

APPROVED BY: Contractor_____

APPROVED BY: Our Lady of the Lake Regional Medical Center_____



**Franciscan
Missionaries
of Our Lady**
HEALTH SYSTEM

Medical Gas Shutdown – Stakeholder Sign-Off Sheet

Project/Shutdown Description:

Location/Area Affected:

Planned Date & Time of Shutdown:

Shutdown Coordinator/PM:

ILSM Assessment Completed By:

#	Department	Title	Date	ILSM Approval (Yes/No)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



**Franciscan
Missionaries
of Our Lady**
HEALTH SYSTEM

Medical Gas Shutdown – Stakeholder Sign-Off Sheet

#	Department	Title	Date	ILSM Approval (Yes/No)
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				



Medical Gas Shutdown – Stakeholder Sign-Off Sheet

#	Department	Title	Date	ILSM Approval (Yes/No)
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

ADDENDA



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

AS-BUILT DRAWINGS



FMOL Project Number: 2505
Contractor Project Number:
Architect Project Number: 24.006.01

OLOL St. Elizabeth
MOB 3

ASI DOCUMENTS



FMOL Project Number: 2505
Contractor Project Number:
Architect Project Number: 24.006.01

OLOL St. Elizabeth
MOB 3

CERTIFICATE OF OCCUPANCY



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

ELECTRICAL EQUIPMENT & CONTROLS



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

FINISH HARDWARE



FMOL Project Number: 2505
Contractor Project Number:
Architect Project Number: 24.006.01

OLOL St. Elizabeth
MOB 3

FINISH MATERIALS OF FLOORS AND
WALLS



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

FIRE MARSHAL DOCUMENTS



FMOL Project Number: 2505
Contractor Project Number:
Architect Project Number: 24.006.01

OLOL St. Elizabeth
MOB 3

HVAC EQUIPMENT & CONTROLS TEST & BALANCE REPORT



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

ICRA



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

ONE YEAR WARRANTY LETTERS



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

PLUMBING EQUIPMENT



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

SPECIALTIES



FMOL Project Number:	2505
Contractor Project Number:	
Architect Project Number:	24.006.01

OLOL St. Elizabeth
MOB 3

SPECIALTY WARRANTY LETTERS



FMOL Project Number: 2505
Contractor Project Number:
Architect Project Number: 24.006.01

OLOL St. Elizabeth
MOB 3

SUBSTANTIAL COMPLETION

SECTION 007200 – GENERAL CONDITIONS

PART 1 GENERAL

1.01 GENERAL

- A The General Conditions of this Contract will utilize AIA A201, General Conditions of the Contract for Construction, 2017, and hereinafter is referred to as the "General Conditions."
- B The General Conditions shall apply to each and every section of the work as though written in full therein and are made a part of the contract documents by reference.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 007300 – SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 GENERAL

- A The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.
- B The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.
- C Correlation and Intent of the Contract Documents:
 - 1. Sections of Division 01 - General Requirements govern the execution of all sections of the specifications.
 - 2. Summary paragraphs placed at the beginning of the Sections present a brief indication of the principal Work included in that Section, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.
 - 3. The Relation of Specifications and Drawings shall be equal authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above-mentioned disagreements, shall be determined by the Architect.
 - 4. Should the Drawings disagree themselves, figures shall govern over-scaled measurements, large-scaled Drawings shall govern over small scale Drawings, the greater quantity of work or materials shall be furnished and performed; the descriptive writings shall govern over legends indicating material or conditions and the Agreement takes precedence over all other Contract Documents.
 - 5. The Contractor is encouraged to identify apparent conflicts in the Contract Documents prior to bidding. Conflicts not identified prior to bid shall be presumed to have been reasonably considered by the Contractor in the preparation of the bid, subject to review and mutual agreement if subsequently discovered.
 - 6. Instructions, directions and requirements as specified shall be considered to be followed by the phrase "unless otherwise specified or indicated".

1.02 INTERPRETATION

- A 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.

1.03 INFORMATIONAL SUBMITTALS

- A A. Informational submittals may be so identified in the Contract Documents.

1.04 PROFESSIONAL CERTIFICATION

- A A. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 011401 – SITE WORK RESTRICTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 USE OF PREMISES

- A Use of Site: Limit use of premises to work in areas indicated in Section 013000 – Administrative Requirements. Do not disturb portions of site beyond areas in which the Work is indicated.
 - 1. Construction Limits: Confine construction operations to the area as indicated on the Drawings.
 - 2. Access Roads and On-site Storage: Contractor shall not block existing roads or adjacent properties.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - 3. Trees: Contractor shall protect trees during construction. Parking or storage of material within drip line is prohibited
- B Traffic Control: Contractor shall provide adequate traffic control as required for construction in public rights-of-way when deliveries or construction will affect existing roads or parking.
- C Maintenances: Contractor shall keep adjacent roads and parking clean of construction debris or material at all times during construction period.
 - 1. Street sweeper or other cleaning systems may be used as requested by Owner.
 - 2. Any damage to existing roads, drives or public infrastructure by the contractor, its subs or suppliers during this project shall be replaced to current city standards by the contractor at no additional cost to the owner.
- D Coordination with other Projects: Contractor shall be aware that other projects will run concurrently with this project and utilize part of the premises during the project period.
 - 1. Each contractor shall willingly coordinate with one another to maintain access and schedule.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012000 - 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.

1.02 RELATED REQUIREMENTS

- A. Section 005000 - Contracting Forms and Supplements: Forms to be used.
- B. Section 007200 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Forms filled out by hand will not be accepted.
- C. 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. Forms filled out by hand will not be accepted.
- D. Execute certification by signature of authorized officer.
- E. Submit one electronic copy of each Application for Payment.
- F. Include the following with the application:
 - 1. Construction progress schedule, revised and current as specified in Section 013000.
 - 2. Partial release of liens from major subcontractors and vendors.

1.05 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. 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.
- C. 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 and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7-10 days.
- D. 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.
- E. 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 be 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.
- F. Substantiation of Costs: Provide full information required for evaluation.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- H. 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.
- I. 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.

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 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012200 - UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Schedule 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. Section 002113 - Instructions to Bidders: Instructions for preparation of pricing for Unit Prices
- B. Section 004100 - Bid Form
- C. Section 012000 - Price and Payment Procedures: Additional payment and modification procedures

1.03 DEFINITIONS

- A. Unit Price: An amount incorporated in the Bid Form, applicable during the duration of the Work as a basis for payment to the Contractor for Work that may be added to the Contract Sum by appropriate modification, in accordance with the Contract Documents.

1.04 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, materials, equipment, overhead, profit, and all associated costs for the complete and in-place work described.
- B. The Owner reserves the right to authorize Work on a Unit Price basis.
- C. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 PAYMENT

- A. Payment for Work governed by unit prices will be made based on 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.

1.06 SCHEDULE OF UNIT PRICES

- A. **Item #01**: Alternate Flooring Adhesive price per square foot
 - 1. Provide unit price per square foot for alternate flooring adhesive to be used in the event such remediation is required.
- B. **Item #02**: Remedial Floor Coating or Sheet Membrane price per square foot
 - 1. Provide unit price per square foot for floor coating or underlayment to be installed in the event such remediation is required.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Document 002113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.
- B. Document 004100 - Bid Form.

1.03 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.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 01 - Builder's Risk Insurance
 - 1. Base Bid Item: Do not include the cost of Builder's Risk Insurance
 - 2. Alternate Item: Include the cost of Builder's Risk Insurance.
- B. Alternate No. 02 – DOAS-1, associated ductwork and associated KEF-1
 - 1. Base Bid Item: Do not include the cost of mechanical work associated with DOAS-1, as noted on Sheet M2.4 and specified.
 - 2. Alternate Item: Include cost of mechanical work associated with DOAS-1, as noted on Sheet M2.4 and specified.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements
- B. Contractor's Use of Premises
- C. Owner's Construction-Related Hospital Policies
- D. Interim Life Safety Measures
- E. Infection Control Construction
- F. Preconstruction meeting
- G. Progress meetings
- H. Construction progress schedule
- I. Contractor's daily reports
- J. Progress photographs
- K. Requests for Interpretation (RFI) procedures
- L. Submittals for review, information, and project closeout
- M. Number of copies of submittals
- N. Submittal procedures
- O. Submittal review
- P. E-Builder Requirements

1.02 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: General product requirements.
- B. Section 017000 - Closeout Requirements: Additional coordination requirements.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect for this specific project:
 - 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.
- C. Project Management Personnel
1. Project Manager (PM):
 - a. Contractor shall assign a **dedicated** Project Manager for the duration of the project.
 - b. The PM shall be responsible for:
 - 1) Overall project coordination and administration
 - 2) Communication with the Owner and Architect
 - 3) Submittals, RFIs, change orders, and progress documentation
 - 4) Schedule management and meeting facilitation
 - c. The PM shall not be reassigned or replaced without written approval from the Owner.
 2. Superintendent:
 - a. Contractor shall assign a **dedicated, full-time on-site** Superintendent for the duration of the project.
 - b. The Superintendent shall be responsible for:
 - 1) On-site supervision of daily construction activities
 - 2) Safety enforcement and quality control
 - 3) Coordination of subcontractors and vendors
 - 4) Ensuring compliance with contract documents
 - c. The Superintendent shall not be reassigned or replaced without written approval from the Owner.
- D. Sub-contract bids for the following work will only be accepted from the following Subcontractors or vendors. Others may be submitted for approval prior to Bid utilizing AIA A305.
1. Division 21
 - a. BRASSCO
 2. Division 22
 - a. J&J Mechanical
 - b. Louis Mechanical Contractors
 - c. Bob Bernhard & Associates Mechanical, LLC

- d. Enfra
- 3. Division 23
 - a. Bob Bernhard & Associates Mechanical, LLC
 - b. Watson Mechanical Services
 - c. Tech-Test (Test and Balance)
 - d. Enfra
- 4. Division 26
 - a. Doyle Electric
 - b. Saia Electric
- 5. Division 27
 - a. In-Telecom
- 6. Division 28
 - a. Johnson Controls (Fire Alarm)

1.04 CONTRACTOR'S USE OF PREMISES

- A. Contractor staging and access to the Construction areas will be identified on a staging diagram and will be discussed at the Preconstruction meeting.
- B. It is the intent that Contractors have a normal work schedule except where operations disrupt tenants. Any operations that will disturb occupancy must be scheduled at the Owner's convenience.
- C. Work that disrupts the adjacent, occupied Hospital operations, including noise and vibration, may be stopped until that activity is complete. Contractors shall not request extra compensation for this and should schedule such activities to accommodate the Hospital's operations.
- D. General Contractor is responsible for Infection Control measures and permits included in Section 005000 Contracting Forms and Supplements and shall review expected procedures at the Preconstruction meeting with the Owner's Infection Control Officer.
- E. Any mechanical and electrical shutdowns must be scheduled in advance, with the Owner, and shall be done during non-critical times, designated by the Owner. The Contractor will be responsible for any overtime work necessary to accomplish shutdowns at non-critical times, and no extra compensation will be allowed. Shut down Application Form, included in Section 005000 Contracting Forms and Supplements, is required and shall be submitted no less than three (3) days prior to the anticipated shutdown date.
- F. General Contractor will be required to coordinate first floor work with construction team concurrently working within the first-floor behavioral health unit. Proposed sequencing of building systems rework above first floor ceilings for this second-floor bed expansion project

shall be reviewed with FMOL Construction Department prior to the start of construction. No more than two patient rooms within the first-floor behavioral health unit shall be shutdown at a time.

- G. General Contractor is required to keep the site and building clean at all times. General Contractor shall provide one employee, at a minimum, for the sole purpose of housekeeping during active, working hours.
- H. General Contractor's personnel shall not use any of the Hospital's facilities, cafeteria, restrooms, lobbies, etc.
- I. Emergency and fire exits must be maintained at all times.
- J. NO SMOKING shall be allowed on the Hospital campus by any employees of the General Contractor.
- K. Ventilation and air-conditioning on the building's adjacent spaces shall be protected from construction debris and contamination. General Contractor shall temporarily remove glazing where required and install fans and temporary ducts to exhaust air in the construction areas for negative air necessary to balance the building. Negative pressure within construction areas MUST BE MAINTAINED.

1.05 OWNER'S CONSTRUCTION-RELATED HOSPITAL POLICIES

- A. Refer to forms in Section 005000 Contracting Forms and Supplements for documents outlining Owner Policies and Guidelines, in addition to those included in this Section.
- B. After personnel orientation and safety instructions are delivered, a badge will be issued to workers during working hours. BADGES MUST BE WORN BY ALL WORKERS AT ALL TIMES on campus. The General Contractor's Superintendent will coordinate with the Owner. Badges must be issued, signed for, and returned each day. Sign-in sheets must be turned in weekly.
- C. Fire drills are conducted regularly in the hospital. The drill will be announced over the PA system. In the event of a drill, remove all equipment and materials in the hospital corridors and proceed to evacuate the construction site. Close all doors in and around the construction site.
- D. Foul language, crude, and/or inappropriate behavior will not be allowed on Campus. Violators of this policy will be permanently removed from the job.

1.06 INTERIM LIFE SAFETY MEASURES

- A. General Contractor is responsible for completing necessary Interim Life Safety documents included in Section 005000 Contracting Forms and Supplements and shall review expected procedures at the Preconstruction meeting with the Owner.
- B. Joint Commission Accreditation of Healthcare Organizations require hospitals to implement administrative actions designed to temporarily compensate for the hazards posed from

deficiencies to the NFPA Life Safety Code during construction. Efforts must be made by both the Hospital and the construction parties to conform to these measures. The following are the 13 Interim Life Safety measures:

1. Ensure exits provide free and unobstructed egress. Personnel receive training if alternative exits must be designated. Buildings/areas under construction shall maintain escape facilities for construction workers at all times. Means of egress in construction areas are inspected daily. Note: the owner will help maintain free egress throughout the facility. Unobstructed access to the stairwells within the construction zone will need to be monitored by the construction site Supervisor.
2. Ensure free and unobstructed access to Emergency Departments and for emergency forces. Note: No extended parking of construction vehicles or loading and unloading of supply vehicles will be allowed on the front and rear drives of the hospital. Any excessive supply deliveries will need to be approved by the hospital building operations staff. The front and rear drives cannot be blocked at any time.
3. Ensure fire alarm, detection, and suppression systems are not impaired. A temporary, but equivalent, system shall be provided when any fire system is impaired. Temporary systems must be inspected and tested monthly. The Contractor may provide a 24-hour fire watch manned by a certified firefighter as an equivalency or provide a temporary heat detection system throughout the construction area. Note: No impairment of fire alarm, detection, and suppression systems are anticipated outside of the construction area for an extensive period of time. If impairment is anticipated, the Hospital Building Operations staff must be notified in advance.
4. Ensure temporary construction partitions are smoke-tight and built of noncombustible or limited-combustible materials that will not contribute to the development or spread of fire. Note: This is expected for all partitions during the duration of the project.
5. Provide additional fire-fighting equipment and use training for personnel.
6. Smoking shall be prohibited in or adjacent to all construction areas. Note: A no-smoking policy will be enforced at all times. Deviations from policy will not be tolerated.
7. 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. Note: it is expected that debris will be contained within the construction zone and regularly removed from the building. The storage of flammable materials, chemicals, or supplies will not be allowed outside of approved storage containers.
8. Conduct a minimum of two fire drills per shift per quarter in areas where construction activities reduce the level of fire safety required under the life safety code. Note: This is

the responsibility of the Hospital. Participation in the drills is not expected of Construction Workers unless equipment or materials exist outside of the construction zone.

9. Increase hazard surveillance of buildings, grounds, and equipment with special attention to construction areas and storage. Note: This is the responsibility of the Hospital.
10. Train personnel in alternate fire safety procedures when structural or compartmentation features of fire safety are compromised. Note: This is the responsibility of the owner, as deemed necessary.
11. Conduct organization-wide safety education programs to ensure awareness of any life safety code deficiencies, construction hazards, and the interim life safety measures. Note: This is the responsibility of the Hospital, as deemed necessary.
12. Provide hand held fire extinguishers at all entrance/exit points of building or construction area and at all construction entrances into the Hospital/ Medical Facility. Contractor shall provide two ABC type extinguishers per 3,000 sf of construction and a minimum of 2 extinguishers in each construction area. Field verify exact locations with owner.
13. Stairwells which open into construction areas from within the stair shall be locked from the construction side thus preventing any exit into construction areas.

1.07 INFECTION CONTROL CONSTRUCTION – REQUIRED IN AREAS, AS DIRECTED BY OWNER

- A. Infection control construction risk assessment: Class IV: Contractor shall follow all requirements as stated below:
 1. Isolate HVAC system in area where work is being done to prevent contamination of duct system.
 2. Complete all critical barriers or implement control cube method before construction begins.
 3. Install Temporary Barriers and Enclosures, per Section 015614, inside main construction area as dust barrier.
 4. Maintain negative air pressure within worksite using HEPA-equipped air filtration units.
 5. Install negative pressure alarm to ensure negative pressure is maintained.
 6. Seal holes, pipes, conduits and punctures appropriately.
 7. Place sticky step-off dust-mat at entrance and exit of work area.
 8. Construct Anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving the worksite or they can wear cloth or paper coveralls that are removed each time they leave the worksite.
 9. All personnel entering the work site are required to wear shoe covers.
 10. Do not remove barriers from work area until completed project is thoroughly cleaned by housekeeping department.
 11. Vacuum work area with HEPA-filtered vacuums.

12. Wet mop with disinfectant.
13. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
14. Contain construction waste before transporting in tightly covered containers.
15. Cover transport receptacles or carts. Tape covering.
16. Advise staff in affected areas of potential for noise/vibration, and expected activity duration.

1.08 DEMOLITION AND HAZARDOUS CONDITIONS

- A. Prior to commencement of any demolition work, Contractor shall review all available hazardous materials surveys, asbestos reports, and environmental assessments provided by Owner. Contractor shall verify the extent of known hazardous materials within the demolition scope and confirm that required abatement has been completed before proceeding.
- B. Where hazardous materials surveys have not been performed or where existing survey data does not cover the full demolition scope, Contractor shall notify Owner and Architect in writing before proceeding. Owner will arrange for any additional testing or assessment required.
- C. If during demolition or construction operations Contractor encounters suspected hazardous materials not identified in the Contract Documents or in Owner-furnished survey reports, including but not limited to asbestos-containing materials (ACM), lead-based paint (LBP), mold, or other regulated substances, Contractor shall immediately stop work in the affected area and notify Owner and Architect in writing.
- D. Contractor shall secure the affected area to prevent disturbance and protect workers, building occupants, and the public. Work in the affected area shall not resume until Owner has authorized resumption in writing following completion of required testing, assessment, and abatement by a licensed environmental contractor.
- E. Contractor shall not disturb, handle, or dispose of suspected hazardous materials except as authorized in writing by Owner and in full compliance with applicable federal, state, and local regulations, including OSHA 29 CFR 1926.1101 (asbestos), OSHA 29 CFR 1926.62 (lead), and EPA NESHAP requirements.
- F. Demolition activities that generate noise, vibration, dust, or odors affecting adjacent occupied hospital areas shall be scheduled in advance and coordinated with Owner. Contractor shall provide written notice to Owner at least 72 hours prior to commencement of major demolition activities and obtain written approval before proceeding.
- G. Temporary barriers within the demolition zone shall be maintained in accordance with the Infection Control and Interim Life Safety requirements of this Section. Contractor shall verify that

negative air pressure is maintained throughout demolition operations and that debris is contained and removed in covered containers, as specified.

- H. Structural elements shall not be removed or disturbed beyond the limits indicated in the Contract Documents without written authorization from Architect. Where existing conditions differ from those shown on the drawings, Contractor shall submit an RFI before proceeding.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of schedule of values and progress schedule.
 - 3. Submission of initial Submittal schedule.
 - 4. Designation of personnel representing the parties to Contract and Architect.
 - 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 6. Scheduling.
- D. 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.

3.02 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.
 - 4. Contractor's superintendent.

5. Major subcontractors.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 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. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.04 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at Project site and project progress. Upload to OLOL's E Builder Site for this specific project:
 1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. Material deliveries.
 5. Safety, environmental, or industrial relations incidents.
 6. Meetings and significant decisions.
 7. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 8. Testing and/or inspections performed.
 9. List of verbal instruction given by Owner and/or Architect.
 10. Signature of Contractor's authorized representative.

3.05 PROGRESS PHOTOGRAPHS

- A. Submit new photographs weekly, within 3 days after being taken, to OLOL's E Builder Site for this specific project.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

- D. In addition to periodic, recurring views, take photographs of each of the following events:
 - 1. Completion of site clearing.
 - 2. Excavations in progress.
 - 3. Foundations in progress and upon completion.
 - 4. Structural framing in progress and upon completion.
 - 5. Enclosure of building, upon completion.
- E. Take photographs as evidence of existing project conditions.

3.06 REQUESTS FOR INTERPRETATION (RFI)

- A. 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 in a format and with content acceptable to Owner.
 - 3. Upload RFI to OLOL's E Builder Site for this specific project, in addition to submitting to the Architect.
- B. 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.

- C. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- D. 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.
- E. 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.

3.07 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.
- 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 017000 – Closeout Requirements.

3.08 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.

3.09 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 017000 – Closeout Requirements:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format to Architect and upload to OLOL's E Builder Site for this specific project; an electronically-marked up file will be returned.
- B. 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.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 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.
 - 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. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
- 8. Provide space for Contractor and Architect review stamps.
- 9. When revised for resubmission, identify all changes made since previous submission.
- 10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

3.12 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. 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.
- C. 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, Resubmission not required", 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.
 - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit"
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - b. "Rejected"
 - 1) Submit item complying with requirements of Contract Documents.

3.13 E-BUILDER REQUIREMENTS

- A. The following documents shall be submitted (uploaded) by the General Contractor to the Owner's E Builder Site for this specific project:
 - 1. Budget proposals

2. Proposal
3. Permit
4. PCRA/ICCRA forms
5. Submittal register
6. Schedule
7. List of Sub-contractors
8. Daily construction reports
9. MRs
10. PCOs
11. O&M Manuals / As-builts (approved)
12. Clear Lien Certificate
13. Certificate of Completion
14. Occupancy Certificate

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Testing and inspection agencies and services.
- B Control of installation.
- C Tolerances.
- D Manufacturers' field services.
- E Defect Assessment.

1.02 RELATED REQUIREMENTS

- A Document 007200 - General Conditions: Inspections and approvals required by public authorities.

1.03 TESTING AND INSPECTION AGENCIES AND SERVICES

- A General Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.04 CONTRACTOR'S QUALITY-CONTROL PLAN

- A Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for the project.
- C Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- D Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

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 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.

3.03 TESTING AND INSPECTION

- A General Contractor shall employ and pay for services of an independent testing laboratory to perform inspections and tests, unless noted otherwise in this specification, as defined in the General Conditions and where called for in individual sections of this specification.
- B Services will be performed in accordance with requirements of governing authorities and with specific standards.
- C Reports will be submitted to architect in duplicate giving observations and results of tests, indicating compliance or noncompliance with specified standards and with contract documents.
- D Contractor shall cooperate with testing laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested without cost to the owner or laboratory.

1. Notify architect and testing laboratory 24 hours prior to expected time for operations requiring testing services.
2. Notify the laboratory sufficiently in advance of cancellation of required testing operations. The Contractor shall be responsible to the laboratory for charges due to failure to notify.
3. Coordinate with testing laboratory and pay for additional samples and tests for Contractor's convenience or where retesting is required.

3.04 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 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.

3.05 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 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.02 INFORMATIONAL SUBMITTALS

- A Site Logistics Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.03 QUALITY ASSURANCE

- A Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.
 - 6. City ordinances and regulations.

1.04 PROJECT CONDITIONS

- A Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

- A General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY FACILITIES

- A Interior Enclosures:
 - 1. Provide temporary partitions and ceilings 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.
 - 2. Reference Section 015614 Temporary Barriers and Enclosures.
- B Exterior Enclosures:
 - 1. Provide temporary insulated weather-tight closure of exterior openings to accommodate acceptable working conditions and protection of Owner-occupied areas.
 - 2. Provide portable Chain-Link Fencing with Wind Screen surround at General Contractor's staging area and as required to enclose and accommodate construction operations.
Provide minimum of one access gate for equipment and personnel, hinged or sliding type.
Provide locking mechanism operable from both sides.
- C Storage and Fabrication Sheds: Provide sheds - as needed - sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work, as discussed at the Pre-construction meeting.
- B Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 UTILITIES

- A Sanitary Facilities: Provide temporary toilet, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- B Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on

completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

C Electric Power Service:

1. Contractor may connect to existing utilities for construction purposes without charge.
2. Where power tools are connected to existing service, Contractor shall connect them such that they will not create a disruption or fluctuation of service to the Owner's equipment.

Construction operations shall not use emergency power.

D Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

E Water:

1. Contractor may connect to Owner's water for construction purposes without charge.

3.03 SUPPORT FACILITIES INSTALLATION

A General: Comply with the following:

1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B Parking: Comply with Owner's requirements. Refer to Section 01 3000 – Administrative Requirements.

C Project Signs: Provide signage at all construction entrances, indicating Construction Personnel Entrance Only, including any Construction Fencing enclosures. Coordinate final placement and signage verbiage with Owner.

D Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

C Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

- D Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
- E Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F Temporary Fire Protection: Comply with OLOL ILSM Policy. Refer to Section 005000 – Contracting Forms and Supplements.

3.05 MOISTURE CONTROL

- A Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.
- B Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Discard or replace water-damaged material.
 - 4. Do not install material that is wet.
 - 5. Discard, replace, or clean stored or installed material that begins to show discoloration.
 - 6. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D Enclosed Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

3.06 OPERATION, TERMINATION, AND REMOVAL

- A Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Maintain markers for underground lines. Protect from damage during excavation operations.

END OF SECTION

SECTION 015614 – TEMPORARY BARRIERS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary construction barriers, enclosures and passageways.
 - 1. Dust and debris barriers.
 - 2. Construction containment.
 - 3. Security barriers.
- B. Protection of completed Work.
- C. Removal of construction facilities and temporary controls.

1.02 CODES AND REGULATIONS

- A. State and local code requirements.
- B. Fire Regulations: Comply with state and local requirements to maintain ASTM-E84 rating on all components of the system. Additional code requirements may apply per NFPA 101, the IBC or other local or national codes.
- C. Safety Regulations: Comply with requirements of all applicable Federal, State and local safety rules and regulations. Contractor shall be solely responsible for jobsite safety.
- D. Barricades and Barriers: As required by governing authorities having jurisdiction, provide substantial barriers, guardrails and enclosures around Work areas and adjacent to embankments and excavations for protection of workers and the public.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For temporary barriers and enclosures.
 - 1. Include plans, elevations, sections, attachment details, and numbered panel installation sequence].
 - a. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
- C. Samples for Selection: For each type of exposed material, finish, covering, or facing.
 - 1. Include Samples of accessories involving color selection.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each barrier assembly, for tests performed by a qualified testing agency.

1.05 PROTECTION OF EXISTING CONDITIONS

- A. Protection of Adjacent Facilities: Contractor shall restrict Work to limits indicated on the Drawings: Protect existing, adjacent facilities from damage, including soiling and debris accumulation, dust and airborne contamination caused by construction activities.
- B. Protection of Existing Furniture, Fixtures and Equipment: As applicable, provide temporary enclosures, barriers and covers to protect existing furniture, fixtures and equipment remaining in Project area during construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Suggested vendor to meet criteria: RealWall from STARC Systems Inc, 844-596-1784
- B. Submit other vendors for consideration, per Section 002113 Instructions to Bidders.

2.02 PERFORMANCE REQUIREMENTS

- A. Provides an STC rating of 24 per ASTM E-90 and tested per Nationally accredited testing Laboratory.
- B. System is tested and listed per ASTM E-84 Class A (smoke generation and flame spread) through a Nationally accredited Testing Laboratory.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 TEMPORARY BARRIERS AND ENCLOSURES

- A. Temporary Partitions: Erect and maintain rigid panel temporary partitions and temporary closures to limit dust and dirt migration, including migration into existing facilities; to separate areas from dust, mold, odors and noise and to maintain security.
 - 1. Prefabricated modular rigid wall system:
 - a. Wall Panel modules:
 - 1) Lightweight painted aluminum front.
 - 2) 26 ga Galvalume steel back.
 - 3) 1" thick Poly Iso foam core
 - 4) Anodized aluminum frame with integral tongue and groove joint / connection details.
 - 5) 5) Adjustable telescoping height from 6'-10" to 10'-3". Optionally extend heights to 12ft
 - 6) Concealed height locks.
 - 7) Lift and Drop module connections – require no external hardware for connections.

- 8) Multiple widths of panels and doors to meet layout requirements.
- 9) Top gasket to meet ceiling.
- 10) Bottom gasket to avoid marking floor.
- 11) '360 degree' T-slot attachment system.
- 12) '360 degree' Ceiling grid clip.
- b. Doors:
 - 1) Hinged Doors:
 - (a) Features of the Wall Panel Modules Plus
 - (b) Multiple widths including Hinged Double Door
 - (c) Superior 4 way hinge system: Swing in / out / left / right.
 - (d) Adjustable threshold and sweep.
 - (e) Optional removable threshold for passage of heavy carts / gurneys
 - (f) Modular "Over the Door" kit for airtight flexible panel above the door
 - (g) Grade 2 hardware
- c. Accessories
 - 1) Provide accessories as required for a complete installation:
 - 2) Provide adaptable wall interface modules providing up to 2-1/2" of adjustability at either end of a wall system.
 - 3) Provide an adaptable 'filler panel' option either at wall termination or inline the wall panel system for uneven wall termination, passage of utilities or other special needs.
 - 4) Provide a 'flexible' telescoping corner capable of 90-165 degrees of motion to adapt to specific installation requirements.
 - 5) Provide floor and ceiling / deck bracing for free standing wall systems.
2. Joints must be interlocking and/or sealed to prevent dust mitigation without use of tape or other consumables.
3. Barriers must have sound isolation properties to reduce the transfer of construction noise to adjacent occupied areas.
- B. Temporary Barrier Passages: Where passage through dust barrier is necessary, provide gasketed doors that effectively prevent air passage. Doors must be self-closing and positive latching.
- C. Negative Air & Air Filtration: All construction areas shall create and maintain a negative pressure in relation to the adjacent occupied space, per ASHRAE and ICRA standards.

- D. HVAC Protection: Provide dust barriers at HVAC return grilles and air inlets to prevent spread of dust and clogging of filters. Maintain clean pre-filters at all return grilles in areas where the HVAC system must remain in service during construction.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Review existing conditions prior to installation. Ensure that all adjacent walls, floors, ceilings etc, are properly installed, structurally sound and ready to accept temporary walls and enclosures. Prior to any work the contractor shall be responsible to perform, with the owner or owner's agent, a preconstruction checklist or ICRA, as directed by the owner.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protection of Installed Work, General: Provide temporary protection for installed products. Control traffic in the immediate area to minimize damage.
- B. Protective Coverings: Provide protective coverings at walls, projections, jambs, sills, and soffits of openings as necessary to prevent damage from construction activities, such as coatings applications, and as necessary to prevent other than normal atmospheric soiling.

3.03 INSTALLATION

- A. Installation: Install barriers per manufacturer's direction. Comply with all local and national code requirements.

3.04 MAINTENANCE SERVICE

- A. Maintenance: Use all means necessary to maintain temporary barriers and enclosures in proper and safe condition throughout progress of the Work.
- B. Replacement: In the event of loss or damage, promptly restore temporary barriers and enclosures by repair or replacement at no change in the Contract Sum or Contract Time.
- C. Cleanliness: Contractor shall be responsible for maintaining the cleanliness of the temporary wall system and all areas within and around. Wall system must be able to be non-porous and cleanable to ensure zero cross contamination.

3.05 REMOVAL OF TEMPORARY BARRIERS AND ENCLOSURES

- A. Removal of Temporary Barriers and Enclosures: Construction area must be cleaned to the level of the adjacent occupied areas. Final Cleaning should include the Modular Wall panel system - they must be vacuumed, wiped down and cleaned to prevent dust accumulation to mitigate into occupied space during removal and mobilization.

- B. Cleaning and Repairs: Clean and repair damage, soiling and marring caused by installation or use of temporary barriers and enclosures. Panels shall be wiped down and covered to be in a clean state for reuse.

3.06 STORAGE

- A. Storage: Refer to manufacturer's directions on proper procedures and recommendations for the stacking and storage of the modular components.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.02 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Section 002113 – Instructions to Bidders for substitution procedures.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers
- D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.
- E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments.

1.03 SUBMITTALS

- A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.
- C. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.04 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Compliance: Contractor shall take whatever measures deemed necessary to ensure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.06 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
 2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.
- B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
 - a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
 - a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.

- C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.
- D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.
 - 1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
- F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - 2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 - 3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.
- H. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

2.02 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION

3.1 RESTRICTION OF HAZARDOUS SUBSTANCES

- A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.
- B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law,

Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.

- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

SECTION 017000 – CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Closeout Procedures
- B. Final Cleaning
- C. Project Record Documents
- D. Operation and Maintenance Data
- E. Warranties and Bonds
- F. Spare Parts and Maintenance Materials

1.02 CLOSEOUT PROCEDURES

- A. A. Comply with procedures stated in general conditions of the contract for issuance of Certificate of Substantial Completion.
- B. Contractor shall furnish all operations manuals, warranties and other documents required within 21 days of substantial completion.

1.03 FINAL CLEANING

- A. Execute prior to final inspection.
- B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign.
- C. Substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition, replace prefilters of mechanical equipment serving the area under construction.
- D. Remove waste and surplus materials, rubbish, and construction facilities from the project and from the site. Replace any grass, shrubs, etc. to restore to original condition.

1.04 PROJECT RECORD DOCUMENTS

- A. Store documents separate from those used for construction.
- B. Keep documents current; do not permanently conceal any work until required information has been recorded.
- C. At contract closeout, submit documents with transmittal letter containing date, project title, Contractor's name and address, list of documents, and signature of Contractor. **Utilize Owner template Cover Pages included in Section 005000 Contracting Forms to organize documents.**

- D. In addition to the site-maintained record copy, the contractor shall prepare and furnish to the Owner, through the Architect, final record drawings of the completed project. Such drawings shall describe the project as actually built and shall incorporate any changes made during construction.
- E. Final record drawings shall be submitted to the architect/engineer within 21 days of substantial completion of the project.

1.05 OPERATION AND MAINTENANCE DATA

- A. Provide data for:
 - 1. Hardware - Division 8
 - 2. Finish materials - Division 9
 - 3. Equipment - Division 10 and 11
 - 4. Mechanical and Plumbing Equipment and Controls
 - 5. Electrical Equipment and Controls
- B. Submit electronic copies and the number of 8-1/2 x 11 inch three-ring side binders with durable plastic covers as requested by owner, prior to final inspection. Upload electronic copies to E Builder for this specific project.
- C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.
- D. Provide operation and maintenance instructions, arranged by system. For each system give names, addresses, and telephone numbers of subcontractors and suppliers. List:
 - 1. Appropriate design criteria
 - 2. List of equipment
 - 3. Parts list
 - 4. Operating instructions
 - 5. Maintenance instructions, equipment
 - 6. Maintenance instructions, finishes
 - 7. Shop drawings and product data
 - 8. Warranties

1.06 WARRANTIES AND BONDS

- A. Assemble documents executed by subcontractors, suppliers, and manufacturers. Provide table of contents and assemble in binder with durable plastic cover.

- B. Submit material prior to final application for payment.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, and maintenance materials in quantities specified in each section, in addition to that used for construction of work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- D. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- B. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- C. Section 017000 - Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.

PART 2 – NOT USED

PART 3 - EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.
- B. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.
- C. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT

- A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- B. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.

- 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- C. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- D. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- E. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 024100 - DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.

1.02 DEFINITIONS

- A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

- A. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
 - 1. Indicate the extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
 - 2. Summary of safety procedures.
 - 3. Demolition firm qualifications.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.

PART 2 - NOT USED

PART 3 - EXECUTION

3.01 DEMOLITION

- A. Remove portions of the existing building(s) as indicated in the drawings.
- B. Remove paving and curbs required to accomplish new work.

- C. Within area of new construction, remove foundation walls and footings completely.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 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.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 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.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements to remain in place and not 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.
- D. 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.
- E. Hazardous Materials:
 - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. 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.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. 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.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 - 1. Verify 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. Separate areas in which demolition is being conducted from areas that remain occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction 015614 Temporary Barriers and Enclosures .
 - 2. Provide sound retardant partitions of construction and in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- D. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove items indicated on drawings.
- E. 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 to remain in operation, and 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.
- F. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- 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 031000 - CONCRETE FORMWORK AND FORM ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

This section covers design, construction, and treatment of formwork to confine and shape concrete to the required dimensions.

1.02 REFERENCE STANDARDS

- A. ACI STANDARDS
 - ACI 117
 - ACI 301
 - ACI 318
- B. ASTM STANDARDS
 - A 185-02
 - A 615-04b
 - C31 – 03a
 - C39 – 03
 - D994 – 98
 - D1751 – 99
 - FS
 - FS-SS-S-00210

1.03 SUBMITTALS

- A. Formwork Release Agent: Submit data on the Formwork release agent proposed for use with each form surface to be used for acceptance unless otherwise specified in the Contract Documents.
- B. Shop Drawings: When required by Contract Documents, submit shop drawings for Formwork.
- C. Re-shoring: When re-shoring is permitted or required, submit for acceptance the plan of re-shoring procedures and operations in advance.
- D. Control Joints for slabs on grade: If control joints are not shown in slabs on grade on the structural plans, the Contractor is to submit a drawing showing the proposed joint locations to the Architect for approval. Unless otherwise noted on the plans, control joints shall be spaced at 13' - 0" on center each way and shall be no closer than 5' - 0" from grade beam centerlines. Controls can be formed cold joints or saw joints. If saw joints are used the depth shall be as shown on the plans or 25% of the total slab depth. Saw joints shall be installed as soon as the concrete has cured enough such that the saw will not leave an impression on the concrete.
- E. Control Joint Filler: Submit data on control joint filler to be used for acceptance.
- F. Construction Joints: If construction joints other than those indicated in the contract documents are desired, submit a request for acceptance.

- G. Vapor Barrier: Submit data on under-slab vapor barrier for acceptance.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Form-facing material shall be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other acceptable material capable of producing the desired finish. Form-facing material shall produce a smooth, uniform texture on the concrete. Do not use form-facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of concrete surfaces.
- B. Formwork Accessories: Use commercially manufactured accessories for formwork accessories that are partially or wholly embedded in concrete, including ties and hangers. Do not use non-fabricated wire form ties. Where indicated in the Contract Documents, use form ties with integral water barrier plates in walls.
- C. Formwork Release Agents: Use commercially manufactured form release agents that will prevent formwork absorption of moisture, prevent bond with concrete, and not stain the concrete surfaces.
- D. Expansion Joint Filler: Pre-molded expansion joint filler shall conform to ASTM D994, ASTM D1751, or ASTM D1752.
- E. Control Joint Filler: Joint filler is to be either Euco Qwik Joint 200 manufactured by the Euclid Chemical Co., Joint Tite 750 manufactured by L & M Construction Chemicals, Inc., or Sikadur 51 SL manufactured by the Sika Corporation
- F. Other Embedded Items: Sleeves, inserts, anchors, and other embedded items shall be of the material and design indicated in the Contract Documents.
- G. Water Stops: Water stop materials shall be a single component, self-sealing adhesive compound, SF302 Synko-Flex water stop or an approved equal meeting the requirements of FS-SSS-210 and shall have a cross sectional area (as extruded) 1" x 1". Cross section (as installed) 5/8" x 1-1/2".
- H. Rigid Foam Insulation: Lightweight inert compressible materials with a minimum density of 0.70 pounds per cubic foot and a minimum compressive resistance at 1% minimum deformation of 320 pounds per square foot. Rigid foam insulation shall cover the full width of the member above.
- I. Cardboard Form Boxes: Form boxes are double wall corrugated fiber boards, laminated with water resistant adhesives and impregnated with waterproofing agents. Assembled units shall be capable of safely supporting a sustained 350#/sq. ft. for a minimum of thirty-six (36) hours after concrete has been placed. Provide all accessories to prevent concrete intrusion into the form boxes. Assemble per manufacturer's recommendations.
- J. Unless otherwise specified, provide minimum 15 mil vapor barrier under building slabs similar to WR Meadows Sealtight Perminator or Stego Wrap Vapor Barrier. Seal vapor barrier joints with tape as required by manufacturer.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Design and engineering of formwork shall be the responsibility of the Contractor. When required by the Contract Documents, design of formwork and preparation of formwork drawings shall be under the supervision of a professional engineer registered in the state where the work will be done.
- B. Design formwork for construction loads, lateral pressure, and requirements of the applicable building code. Design formwork to withstand the pressure resulting from placement and vibration of concrete and to maintain specified tolerances.
- C. Do not use earth cuts as forms for vertical or sloping surfaces unless required or permitted by the Contract Documents.
- D. Maximum deflection of facing materials reflected on concrete surfaces exposed to view shall be $1/240$ of the span between structural members of the formwork except for architectural concrete.
- E. Locate and detail formed joints to the following requirements:

Locate and form construction joints that least impair strength of the structure, and submit information for acceptance of proposed location and treatment of construction joints that are not indicated on the project drawings. In general, locate construction joints near the middle of the spans of slabs, beams, and girders. When a beam intersects a girder at this joint, the joint in the girder shall be offset a distance equal to or greater than twice the width of the beam. Located joints in walls and columns at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs. Make joints perpendicular to the main reinforcement.

- F. Provide saw cut control joints in slabs on grade spaced at 12' – 6" maximum centers in both directions unless they are shown otherwise on the plans. Sawing is to begin as soon as the surface is firm enough so that it will not be torn or damaged by the blade.
- G. For smooth form finish, arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum. Support facing material with studs or other backing capable of preventing excessive deflection within the tolerances specified.

2.03 FABRICATION AND MANUFACTURE

- A. Formwork shall be tight to prevent loss of mortar from concrete. Provide watertight formwork when architectural concrete is specified.
- B. Place $3/4$ " minimum chamfer strips in the corners of formwork to produce beveled edges on permanently exposed surfaces unless otherwise specified. Do not bevel re-entrant corners of edges of formed joints of concrete unless specified in the Contract Documents.
- C. Provide temporary openings at the base of column and wall formwork and at other points where necessary to facilitate cleaning and inspection. Clean and inspect immediately before concrete is placed.

- D. Fabricate form ties so ends or end fasteners can be removed, terminate the embedded portion of ties not less than (2) diameters, or twice the minimum cross-section dimension of the ties, from the formed concrete surface. In no case shall this distance be less than 3/4".
- E. Locate water stops in joints where indicated on the Contract Documents. Use pieces of pre-molded water stop with a maximum practicable length to hold the number of end joints to a minimum. Make joints in water stops in accordance with the manufacturer's recommendations. Ensure that joints develop effective water tightness equal to the continuous water stop material, permanently develop not less than 50% of the mechanical strength of the parent section, and permanently retain flexibility.

PART 3 EXECUTION

3.01 CONSTRUCTION AND ERECTION OF FORMWORK

- A. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement by not more than 1". Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.
- B. Unless specified in the Contract Documents, construct formwork so concrete surfaces conform to tolerance limits of ACI 117. The class of surface for offset between adjacent pieces of formwork facing material shall be Class C in accordance with ACI 117, unless otherwise specified.
- C. Provide positive means of adjustment (wedges or jacks) of shores and struts. Do not make adjustments in the formwork after concrete has taken its initial set. Brace formwork securely against lateral deflection and lateral instability.
- D. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface prior to removal of formwork. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds when the finish specified requires the use of such equipment.
- E. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness.
- F. Fasten form wedges in place after final adjustment of forms and prior to concrete placement.
- G. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement.
- H. Construct formwork for wall openings to facilitate removal and to counteract swelling of wood formwork.
- I. Provide runways for moving equipment and support runways directly on the formwork or structural member without resting on the reinforcing steel.

- J. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work prior to concrete placement.
- K. Position and support expansion joint material, water stops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
- L. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign material before concrete is placed.
- M. Cover surfaces of formwork with acceptable formwork release agent. Apply form release agent before placing reinforcing steel and concrete. A field-applied formwork release agent or sealer of an acceptable type or an acceptable factory-applied non-absorptive liner may be used. Do not allow formwork release agent to puddle in the forms. Do not allow formwork release agents to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed.

3.02 REMOVAL FOR FORMWORK

- A. When finishing is required, remove forms as soon as removal operations will not damage concrete.
- B. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform needed repairs or treatment required at once and follow immediately with specified curing.
- C. Loosen wood formwork for wall openings when this can be accomplished without causing damage to concrete.
- D. Do not allow removal of formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete to damage the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.
- E. Unless otherwise specified, leave formwork and shoring in place to support the weight of concrete in beams, slabs, and in place structural members until concrete has reached the specified compressive strength, f_c , or for no less than fourteen (14) days. If a lower compressive strength is proposed for removal for formwork and shoring, submit detail plans for review and acceptance, unless otherwise specified. When shores and other vertical supports are arranged to allow the form facing material to be removed without loosening or disturbing the shores and supports, the facing material may be removed after cumulative curing at not less than 50⁰ F for twenty-four (24) hours after placing concrete, provided the concrete is sufficiently hard to not be damaged by form removal, and provided curing operations are maintained.
- F. Construct formwork to permit easy removal.

3.03 RESHORING

- A. When re-shoring is permitted or required, submit for acceptance a plan of re-shoring procedures and operations prior to their use.
- B. While re-shoring is under way, do not permit any construction load on new construction.

- C. During re-shoring, do not allow concrete in beam, slab, column, or any structural member to be loaded with combined dead and construction loads in excess of the loads permitted by the Architect/Engineer for the concrete compressive strength at the time of re-shoring.
- D. Place re-shores in sequence with stripping operation.
- E. Tighten re-shores to carry the required loads without over-stressing the concrete members. Leave re-shores in place until tests indicate that the concrete compressive strength has attained the minimum value specified.
- F. For floors supporting shores under newly placed concrete, leave in place the original supporting shores or re-shore. The shoring or re-shoring system and the supporting slabs shall have capabilities sufficient to resist the anticipated loads. Re-shores shall be located directly under a shore position.
- G. In multi-story buildings, extend re-shoring over a sufficient number of stories, two (2) stories minimum to distribute the weight of newly placed concrete, forms, and construction live loads.

3.04 STRENGTH OF CONCRETE REQUIRED FOR REMOVAL OF FORMWORK

When removal of formwork or re-shoring is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when test cylinders, field cured along with the concrete they represent, have reached the compressive strength specified for removal of formwork or re-shoring. Mold cylinders in accordance with ASTM C 31, and cure them under the same conditions for moisture and temperatures as used for the concrete they represent. Test cylinders in accordance with ASTM C 39.

3.05 FIELD QUALITY CONTROL

- A. Establish and maintain controls and bench marks in an undisturbed condition until final completion and acceptance of the project.
- B. Variations from plumb and designated building lines shall not exceed the tolerances specified in ACI 117.

END OF SECTION

PART 1 DESCRIPTION

1.01 DESCRIPTION

This section covers materials, fabrication, placement and tolerances of reinforcement and reinforcement accessories.

1.02 REFERENCE STANDARDS

- A. ACI STANDARDS
 - ACI 117
 - ACI 301
 - ACI 318
- B. ASTM STANDARDS
 - A 185-02
 - A 615-04b

1.03 SUBMITTALS, DATA AND DRAWINGS

Unless otherwise required by Contract Documents, submit the following data and drawings for review and acceptance before fabrication and execution in accordance with the General Requirements of this project.

- A. Placing Drawings: Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement supports.
- B. Splices: Submit a list and request to use splices not indicated in Contract Documents.
- C. Mechanical Connections: Submit request for the use of mechanical connections not shown on the Project Drawings.
- D. Field Bending: Submit requests and procedure to field bend or straighten reinforcement partially embedded in concrete.

1.04 MATERIALS DELIVERY, STORAGE, AND HANDLING

Prevent bending, coating with earth, oil, or other material, or otherwise damaging the reinforcement.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars: Bars used as reinforcement shall be deformed except spirals and welded wire fabric, which may be plain. Reinforcement shall be ASTM A 615 Grade 60. Provide weldable Grade 60 reinforcement where bars are called for or required to be welded.
- B. Welded Wire Fabric: ASTM A 185, with welded intersections spaced not farther apart than twelve (12) inches in the direction of principal reinforcement.

- C. Wire Reinforcement Supports: Unless otherwise specified or permitted, use wire reinforcement supports complying with Class 1, maximum protection, or Class 2, moderate protection as indicated in Chapter 3 - Bar Supports of the CRSI Manual of Standard Practice.
- D. Unless otherwise noted, provide corner bars at all bar intersections. Corner bars shall be the same size as the larger of the intersecting bars and each leg shall be forty-four (44) bar diameters in length.

2.02 FABRICATION

Bend all reinforcement cold unless heating is permitted. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.

PART 3 EXECUTION

3.01 PREPARATION

When concrete is placed, all reinforcement shall be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory provided the minimum nominal dimensions, nominal weight, and the minimum average height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

3.02 PLACEMENT

- A. Tolerances: Place, support, and fasten reinforcement as shown on the Project Drawings. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed. Placing tolerances shall not reduce cover requirements except as specified in ACI 117.
- B. Reinforcement Relocation: When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embedded items, submit the resulting arrangement of reinforcement for acceptance.
- C. Concrete Cover: Minimum concrete cover for reinforcement shall be in accordance with the latest edition of ACI 318 - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE.

Tolerances on minimum concrete cover shall meet the requirements of ACI 117.

- D. Reinforcement supports: Unless otherwise permitted:
 - 1. Place reinforcement supported from the ground or mud mat on precast concrete reinforcement supports.
 - 2. Place reinforcement supported from formwork on reinforcement supports made of concrete, metal, or plastic.
- E. Welded wire fabric: For slabs on grade, extend welded wire fabric to within two (2) inches of the concrete edge. Lap edges and ends of fabric sheets a minimum of one (1) mesh spacing. Welded wire fabric may extend through contraction joints only where permitted. Support welded wire fabric during placing of concrete to assure required positioning in the slab. Do not place welded wire fabric on grade and subsequently raise into position in concrete.
- F. Column dowels: Furnish and use templates for placement of column dowels unless otherwise permitted.

- G. Make splices as indicated on the Project Drawings unless otherwise permitted. Mechanical connections for reinforcement not shown on the Project Drawings may be used when accepted.
- H. Field bending or straightening: When permitted, bend or straighten reinforcement partially embedded in concrete in accordance with the following procedures. Reinforcing bar sizes No. 3 through No. 5 may be bent cold the first time provided reinforcing bar temperature is above 32⁰ F.
- I. Minimum inside bend diameters shall be six (6) bar diameters for No. 3 through No. 8 bars, eight (8) bar diameters for No. 9 through No. 11 bars, and ten (10) bar diameters for No. 14 and No. 18 bars. In addition, beginning of the bend shall not be closer to the concrete surface than the minimum diameter of bend.
- J. Field cutting of reinforcement: Reinforcement shall not be cut in the field except when specifically permitted.
- K. Reinforcement through expansion joint: Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one (1) side of a joint and water stops may extend through the joint.

END OF SECTION

PART 1 GENERAL REQUIREMENTS

1.01 DESCRIPTION – STRUCTURAL CAST-IN-PLACE CONCRETE

1.02 REFERENCE STANDARDS AND CITED PUBLICATIONS

- A. American Concrete Institute (ACI) standards:
 - ACI 301 Standard Specification for Structural Concrete
 - ACI 117 Specifications for Tolerances for Concrete Construction and Materials
- B. American Society for Testing & Materials (ASTM) standards:
 - A 185 Specification for Steel Welded Wire Fabric, Plain for Concrete Reinforcement
 - A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - C 31 Method of Making and Curing Concrete Test Specimens in the Field
 - C 33 Specification for Concrete Aggregates
 - C 39 Test Method of Compressive Strength of Cylindrical Concrete Specimens
 - C 42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - C 94 Specification for Ready-Mixed Concrete
 - C 138 Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 - C 143 Test Method for Slump of Portland Cement Concrete
 - C 150 Specification for Portland Cement Concrete
 - C 171 Specification for Sheet Materials for Curing Concrete
 - C 172 Method of Sampling Freshly Mixed Concrete
 - C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 - C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory Method
 - C 260 Specification for Air-Entraining Admixtures for Concrete
 - C 309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - C 494 Specification for Chemical Admixtures for Concrete
 - C 595 Specification for Blending Hydraulic Cements
 - C 597 Test Method for Pulse Velocity through Concrete
 - C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as Mineral Admixture in Portland Cement Concrete
 - C 80 Test Method for Rebound Number of Hardened Concrete
 - C 989 Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
 - C 1017 Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 - C 1064 Test Methods for Temperature of Freshly Mixed Portland Cement Concrete
 - C 1077 Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

1.03 SUBMITTALS

- A. General – Submittals required in this specification shall be submitted for review and acceptance.

- B. Product Data – Submit (5) sets of manufacturer's product data with application and installation instructions for proprietary materials and items, admixtures, patching compounds, curing compounds, and others as requested by the Architect.
- C. Testing and Inspection Reports – Testing agencies shall report results of concrete and concrete materials tests and inspections performed during the course of the work to the Owner, Architect/Engineer, Contractor, and the Concrete Supplier. Strength test reports shall include location in the work where the batch represented by test was deposited and the batch ticket number. Final reports shall be provided within (7) days of test completion.

1.04 QUALITY ASSURANCE

- A. General – Concrete materials and operations may be tested and inspected by the Testing Agency as work progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered, nor shall it obligate Architect/Engineer for final acceptance.
- B. Testing Agencies – Agencies that perform testing services on concrete materials shall meet the requirements of ASTM C 1077. Testing agencies performing the test shall be acceptable to Architect/Engineer prior to performing any work. Field tests of concrete shall be made by an ACI Concrete Field Testing Technician Grade 1 in accordance with ACI CP1 or equivalent. Equivalent certification programs shall include requirements for written and performance examinations as stipulated in ACI Publication CP1.
- C. Testing Responsibilities of Contractor:
 - 1. Submit data on qualifications of proposed testing agency for acceptance. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
 - 2. Duties and Responsibilities: Unless otherwise specified in the Contract Documents, the Contractor shall assume the following duties and responsibilities:
 - a. Qualify proposed materials and establish mixture proportions.
 - b. Furnish any necessary labor to assist the testing agency in obtaining and handling samples at the project site or at the source of the materials.
 - c. Advise the testing agency at least (24) hours in advance of operations to allow for completion of quality tests and for assignment of personnel.
 - d. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the job site for initial curing as required by ASTM C 31.
 - e. Submit data and test documentation on materials and mixture proportions.
 - f. Submit quality control program of the concrete supplier and provide copies of all test reports.
- D. Testing Services – The testing agency shall perform the following testing services:
 - 1. Obtain composite samples in accordance with ASTM C 172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement. Obtain at least (1) composite sample for each 50 yd³, or fraction thereof, of each design mixture of concrete placed in any (1) day. When the total quantity of concrete with a given design mixture is less than 25 yd³, the strength tests may be waived by the Architect/Engineer, if in his judgment, adequate evidence of satisfactory strength is provided.

2. Conduct strength tests of concrete during construction in accordance with the following procedures:
 - a. Mold and cure (4) cylinders from each sample in accordance with ASTM C 31. Record any deviations from the ASTM requirements in the test report.
 - b. Test cylinders in accordance with ASTM C 39. Test (1) specimen at (7) days for information, (2) specimens at (28) days for acceptance, and hold (1) specimen to be tested as directed by the Architect/Engineer. The compressive strength test results for acceptance shall be the average of the compressive strengths from the (2) specimens tested at (28) days.
3. Determine slump of each composite sample and whenever consistency of concrete appears to vary, using ASTM C 143. In addition, the testing laboratory shall also estimate the slump of every truck by visual inspection and include the slump estimates in their report. Additional actual slump tests shall also be taken as directed by the Architect or Engineer.
4. Determine temperature of each composite sample in accordance with ASTM C 1064.
5. Air content tests will be made on samples from the first (3) batches in the placement and until (3) consecutive batches have air contents within the range specified at which time (1) test will be performed for each (100) cubic yards or fraction thereof of each design mixture of concrete placed in any (1) day. This test frequency will be maintained until a batch is not within the range specified, at which time testing of each batch will be resumed until (3) consecutive batches have air contents within the range specified. Additional tests may be performed as necessary for control. These air content tests may be taken on composite samples or on samples from the batch at any time after discharge of (2) cubic feet of concrete.
6. When it appears that material furnished or work performed by the Contractor fails to conform to the Contract Documents, testing agency will immediately report such deficiency to the Architect/Engineer, Contractor, and concrete supplier.
7. Testing agency and its representatives are not authorized to revoke, alter, relax, enlarge, or release any requirement of the Contract Documents, nor to accept any portion of the work.
8. The testing agency will report all test and inspection results to the Architect/Engineer, Contractor and concrete supplier within (7) days after tests and inspections are performed.

E. Additional Testing and Inspection Services

1. The testing agency shall perform the following testing services when necessary, at the Contractor's expense.
 - a. Additional testing and inspection required because of changes in materials or mixture proportions requested by the Contractor.
 - b. Additional testing of materials or concrete occasioned by failure to meet specification requirements.
2. When material furnished or work performed by the Contractor fails to conform to the Contract Documents the testing agency will perform the following testing services when required by the Architect/Engineer at the Contractor's expense:

- a. Inspect concrete batching, mixing, and delivery operations.
- b. Other testing or inspection services as required by the Architect/Engineer.

F. Tests on Hardened Concrete in Place

1. General: Tests on hardened concrete will be performed by the testing agency when such tests are needed. Testing shall be at the Contractor's expense when tests are performed to verify the strength of the structure when required by this specification. Owner will pay costs if tests are at his request and not required by this specification.
2. Non-destructive Tests: Use of the rebound hammer in accordance with ASTM C 805, pulse velocity methods in accordance with ASTM C 597, or other non-destructive devices may be permitted by the Architect/Engineer in evaluating the uniformity and relative concrete strength in place, or for selecting areas to be cored.
3. Core Tests
 - a. When required by the Architect/Engineer, cores shall be obtained and tested in accordance with ASTM C 42.
 - b. At least (3) representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores is to be determined by the Architect/Engineer. If, before testing, cores show evidence of having been damaged subsequent to or during removal from the structure, replacement cores shall be taken.
 - c. Fill core holes with low slump concrete or grout of a strength equal to or greater than the original concrete.

G. Evaluation of Concrete Strength Tests

1. Standard molded and cured strength specimens: Test results from standard molded and cured test cylinders shall be evaluated separately for each specified concrete design mixture. Evaluation will be valid only if tests have been conducted in accordance with procedures specified. For evaluation, each specified design mixture shall be represented by at least (5) tests.
2. Non-destructive Tests: Test results will be evaluated by the Architect/Engineer and will be valid only if tests have been conducted by properly calibrated equipment in accordance with recognized standard procedures.
3. Core Tests: Core tests will be evaluated by the Architect/Engineer and will be valid only if tests have been conducted in accordance with specified procedures.

H. Acceptance of Concrete Strength

1. Standard molded and cured strength specimens: The strength level of concrete will be considered satisfactory when the averages of all sets of (3) consecutive compressive strength test results equal or exceed the specified compressive strength f_c' and no individual strength test result falls below the specified compressive strength f_c' by more than (500) psi.
2. Non-destructive tests: Non-destructive tests shall not be used as the sole basis for accepting or rejecting concrete, but may be used when permitted to evaluate concrete where standard molded and cured cylinders have yielded results not meeting the criteria in Paragraph 1.

3. Core Tests: Strength level of concrete in the area represented by core tests will be considered adequate when the average compressive strength of the cores are equal to at least 85 percent of specified compressive strength f_c , and if not single core is less than 75 percent of the specified compressive strength, f_c .

I. Field Acceptance of Concrete

1. Air content: Concrete not within the limits of the air-entrainment specified shall not be used in the work.
2. Slump: Concrete not within the slump limits specified at the point of placement shall not be used in the work.
3. Temperature: Concrete not within temperature limits specified shall not be used in the work.

1.05 ACCEPTANCE OF STRUCTURE

A. General – Completed concrete work shall conform to applicable requirements of this Specification.

1. Concrete work that fails to meet (1) or more requirements of the Contract Documents but subsequently is repaired to bring the concrete into compliance may be accepted.
2. Concrete work that fails to meet (1) or more requirements of the Contract Documents and cannot be brought into compliance will be rejected.
3. Repair rejected concrete work by removing and replacing or by reinforcing with additional construction required by the Architect/Engineer.
4. Submit for acceptance the proposed repair methods, materials, and modifications needed to assure that concrete work will meet requirements of the Contract Documents.
5. Document repair work to bring concrete work into compliance with the Contract Documents and submit the documentation to the Architect/Engineer for acceptance.
6. The Contractor shall pay all costs to bring concrete work into compliance with requirements of this Specification.
7. Concrete members cast in the wrong location will be rejected.

B. Dimensional Tolerances

1. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of ACI 117, may be considered deficient in strength and subject to the provisions of Paragraph D, Strength of Structure.
2. Formed surfaces resulting in concrete outlines large than permitted by ACI 117 may be rejected. Excess materials will be subject to removal when required by the Architect/Engineer.
3. Inaccurately formed concrete surfaces that exceed ACI 117 tolerances may be rejected.
4. Concrete with tolerances and defects exceeding the specified limitations may be rejected.

C. Appearance

1. Concrete exposed to view with defects that adversely affect the appearance of the specified finish will be rejected.
2. Concrete not exposed to view may be rejected for non-conforming appearance.

D. Strength of Structure

1. Criteria for determining potential strength deficiency: Strength will be considered deficient and concrete work will be rejected when the work fails to comply with requirements which control the strength of the structure including, but not limited to, the following conditions:
 - a. Concrete strength failing to comply with requirements of the Contract Documents.
 - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of the Contract Documents.
 - c. Concrete elements which differ from the required dimensions or location.
 - d. Curing not in accordance with Contract Documents.
 - e. Inadequate protection of concrete from extreme temperature and other environmental conditions during early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents, or premature removal of formwork resulting in deficient strength.
2. Action required when strength is potentially deficient: When strength of the structure is considered potentially deficient, corrective actions may be required by the Architect/Engineer.

E. Durability

1. Criteria for determining potential durability deficiency: Durability of concrete work will be considered deficient and the concrete work will be rejected when it fails to comply with the requirements which control durability of the structure including, but not limited to, the following conditions:
 - a. Strength failing to comply with that specified.
 - b. Materials for concrete not conforming with the specifications for Cements, Aggregated, Water, and Admixtures, including air entrainment.
 - c. Concrete not conforming with the air-entrainment requirements in the Contract Documents.
 - d. Curing not in accordance with the Contract Documents.
 - e. Inadequate protection of concrete from temperature and other environmental conditions during early stages of hardening and strength development.
2. Action required when durability is potentially deficient: When durability of the structure is considered to be deficient, the following actions will be taken by the Architect/Engineer:
 - a. Require that samples of the ingredient materials used in the concrete be obtained and tested.
 - b. Require that samples of hardened concrete be obtained from the structure by coring, sawing, or other acceptable means.

- c. Require a laboratory evaluation of concrete and concrete materials to assess the ability of concrete to resist weathering action, chemical attack, abrasion, or other deterioration.
- d. Concrete rejected for lack of durability shall be repaired or replaced as directed by the Architect/Engineer.

1.06 PROTECTION OF IN-PLACE CONCRETE

- A. Loading and support of concrete – Do not allow construction loads to exceed the superimposed load which the structural member, with necessary supplemental support, is capable of carrying safely and without damage.
- B. Protection from mechanical injury – during the curing period, protect concrete from damaging mechanical disturbances including load stresses, shock and harmful vibration. Protect concrete surfaces from damage by construction traffic, equipment, materials, rain or running water, and other adverse weather conditions.

PART 2 CONCRETE MIXTURES

2.01 DESCRIPTION

Requirements for materials, proportioning, production, and delivery of concrete.

2.02 SUBMITTALS

- A. Mixture proportions – Submit concrete mixture proportions by weight.
- B. Concrete materials – Submit the following information for concrete materials:
 - 1. For cementitious material: types, classes.
 - 2. For aggregates: types, pit or quarry locations, producers' names, gradations, specific gravities.
 - 3. For admixtures: types, brand names, producers.
 - 4. For water and ice: source of supply.
- C. Mixture proportion adjustments – Submit any adjustments to mixture proportions or changes in materials, along with supporting documentation, made during the course of the work.
- D. Time of discharge – When it is desired to exceed time for discharge of concrete required by ASTM C 94, submit a request along with a description of the precautions to be taken.

2.03 PRODUCTS

- A. Materials
 - 1. Cementitious material – Cementitious material shall consist of Portland Cement conforming to ASTM C 150, or blended hydraulic cement conforming to ASTM C 595, or Portland Cement conforming to ASTM C 618, or a Portland Cement conforming to ASTM C 150 and a blast furnace slag cement conforming to ASTM C 989. Cementitious material used in concrete shall be of the same brand and type, and from the same plant of manufacture

as the cementitious material used in the concrete represented by the submitted field test data or used in the trial mixtures.

2. Aggregates – Aggregates shall conform to ASTM C 33 unless otherwise specified. When a single size or a combination of (2) or more sizes of coarse aggregates are used, the final gradation shall conform to the grading requirements of ASTM C 33 unless otherwise specified or permitted.
3. Water and ice – Mixing water for concrete and water used to make ice shall meet the requirements of ASTM C 94.
4. Admixtures – When required or permitted, admixtures shall meet the requirements of the following:
 - a. Air entraining admixtures – ASTM C 260.
 - b. Chemical admixtures – ASTM C 494.
 - c. Chemical admixtures for use in producing flowing concrete – ASTM C 1017.
5. Change of materials – When brand, type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new data or evidence which indicates that the change will not adversely affect the relevant properties of the concrete shall be submitted for acceptance prior to use in concrete.

B. Performance and Design Requirements

1. Cementitious material content – The cementitious material content shall be adequate for concrete to satisfy the specified requirements for strength, water-cementitious material ratio and finishing ability.
2. Slump – Slump shall not exceed the specified slump. Concrete shall have, at the point of delivery, a slump of:
 - a. Ramps and sloping surfaces – 3" maximum
 - b. Reinforced foundations – 1" minimum to 3" maximum
 - c. Other concrete – 2" minimum to 4" maximum
 - d. Determine the slump by ASTM C 143. Slump tolerances shall meet the requirements of ACI 117. When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 6 inches at the point of delivery after the admixture is added, unless otherwise specified.
 - e. Under no circumstances shall the slump exceed 8-1/2"
3. Size of coarse aggregate – Except when otherwise specified or permitted, nominal maximum size of coarse aggregate shall not exceed three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimensions between sides of forms, or one-third of the thickness of slabs or toppings.
4. Air content – See plans for air-entrainment requirements. Unless otherwise specified, air content for exterior exposed concrete at the point of delivery shall conform to the requirements of ACI 301, Table 4.2.2.4 for mild exposure. For specified compressive strengths above 5,000 psi, the total air contents indicated in Table 4.2.2.4 may be reduced by one percent.

5. Chloride ion concentration – Unless otherwise specified, maximum water soluble chloride ion concentrations in hardened concrete at ages from (28) to (42) days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed .30 % by weight of cement. When testing is performed to determine water soluble chloride ion content, test procedures shall conform to AASHTO T 260.
6. Concrete temperature – When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40° F for more than (3) successive days, concrete shall be delivered to meet the following minimum temperature immediately after placement:
 - 55° F for sections less than 12 in. in the least dimension,
 - 50° F for sections 12 in. to 36 in. in the least dimension,
 - 45° F for sections 36 in. to 72 in. in the least dimension,
 - 40° F for sections greater than 72 in. in the least dimension.

The temperature of concrete as placed shall not exceed these values by more than 20° F. These minimum requirements may be terminated when temperatures above 50° F occur during more than half of any (24) hour duration. Unless otherwise specified or permitted, the temperature of concrete as delivered shall not exceed 90° F.

7. Strength – The compressive strength is to be as specified on the drawings. Unless otherwise specified, strength requirements shall be based on the 28-day compressive strength determined on a 6 x 12 inch cylindrical specimens made and tested in accordance with ASTM C 31 and C 39 respectively.
8. Water-cementitious material ratio – The water-cement or water-cementitious material ratio of the concrete for each portion of the work shall not exceed .50 for 3,000 psi concrete and .48 for higher strength concrete.
 - a. If cementitious or pozzolanic mineral admixtures conforming to ASTM C 989 or ASTM C 618 are used, the cement portion of the water-cement ratio shall be the total weight of cementitious materials.
 - b. The combined weight of fly ash and pozzolan conforming to ASTM C 618 shall not exceed 20 percent of the total weight of cementitious material. The fly ash and pozzolan present in a ASTM Type IP or IPM blended cement conforming to ASTM C 595 shall be included in the calculated percentage.
9. Proportioning – Proportion concrete to conform with Paragraph C – Performance and Design Requirements, to provide workability and consistency so concrete can be worked readily into forms and around reinforcement without segregation or bleeding, and to provide the compressive strength specified.

2.04 EXECUTION

- A. Measuring, batching, and mixing – Production facilities shall produce concrete of the specified quality and conforming to the requirements of this Specification. Unless otherwise specified, measure, batch and mix concrete materials and concrete in conformance with ASTM C 94.
- B. Delivery – Deliver concrete which will possess the specified characteristics in the freshly mixed state at the point of placing. Transport and deliver concrete in equipment conforming to the requirements of ASTM C 94.

1. Slump adjustment – When concrete arrives at the point of delivery with a slump below that which will result in the specified slump at the point of placement and is unsuitable for placing at that slump, the slump may be adjusted to the required value by adding water up to the amount allowed in the accepted mixture proportions unless otherwise specified by the Architect/Engineer. Addition of water shall be in accordance with ASTM C 94. Do not exceed the specified water-cementitious material ratio or slump. Do not add water to concrete delivered in equipment not acceptable for mixing. After plasticizing or high-range water-reducing admixtures are added to the concrete at the site to achieve flowable concrete, do not add water to the concrete. Measure slump and air content of air-entrained concrete, after slump adjustment, to verify compliance with specified requirements.
2. Time of discharge – Time for completion of discharge shall be as specified by ASTM C 94, unless otherwise permitted. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, verify that air content of air-entrained concrete, slump, and temperature of concrete are as specified.

PART 3 HANDLING, PLACING, AND CONSTRUCTING

3.01 EXECUTION

A. Preparation

1. Do not place concrete until data on materials and mixture proportions are accepted.
2. Before placing concrete in forms, complete the following:
 - a. Comply with formwork requirements specified.
 - b. Remove dirt, water, and other foreign material from surfaces, including reinforcement and embedded items, against which concrete will be placed.
 - c. Comply with reinforcing steel placement requirement specified.
 - d. Position and secure in place expansion joint material, anchors, and other embedded items.
 - e. Obtain acceptance of finished preparation.
3. Before placing a concrete slab on grade, clean foreign material from the Subgrade and complete the following:
 - a. In-place density of Subgrade soils shall be uniform throughout the area and at least the minimum required by the Contract Documents.
 - b. Subgrade shall be free from frost or ice.
 - c. Subgrade shall be moist with no free water and no muddy or soft spots.
4. When high ambient temperatures necessitate protection of concrete immediately after placing or finishing, make provisions in advance of concrete placement for windbreaks, shading, fogging, sprinkling, ponding, or wet covering.
5. During ambient temperature conditions described in Section 2.03, Paragraph B, Subparagraph 6 – Concrete Temperature, make provisions in advance of concrete placement to maintain the temperature of the concrete as specified. Use heating, covering, or other means adequate to maintain required temperature without overheating or drying of concrete due to concentration of heat. Do not use combustion

heaters unless precautions are taken to prevent exposure of the concrete to exhaust gases containing carbon dioxide.

B. Placement of Concrete

1. Wet weather – Do not begin to place concrete while rain, sleet, or snow is falling. Do not allow rain water to increase mixing water or to damage the surface of the concrete.
 2. Cold weather – Concrete temperatures and ambient temperatures shall meet minimum temperature requirements of Section 2.03, Paragraph B, Sub Paragraph 6 – Concrete Temperature.
 3. Hot weather – The temperature of concrete as placed shall not exceed 90° F unless otherwise permitted. Loss of slump, flash set, or cold joints due to temperature of concrete as placed will not be acceptable. When temperature of concrete exceeds 90° F, obtain acceptance, when required, of proposed precautionary measures. When temperature of steel reinforcement, embedments, or forms is greater than 120° F, fog steel reinforcement, embedments, and forms with water immediately prior to placing concrete.
 4. Conveying – Convey concrete from mixer to the place of final deposit rapidly by methods which prevent segregation or loss of ingredients and will assure the required quality of concrete. Do not use aluminum pipes or chutes.
 5. Depositing – Deposit concrete continuously in (1) layer or in layers to have fresh concrete deposited on in-place concrete that is still plastic. Do not deposit fresh concrete on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section, unless construction joint requirements are met. Do not use concrete that has surface dried, partially hardened, or contains foreign material. Do not subject concrete to any procedure that will cause segregation. Deposit concrete as near as practicable to the final position to avoid segregation.
 6. Consolidating – Consolidate concrete by vibration. Concrete shall be thoroughly worked around reinforcement and embedded items and into corners of forms, eliminating all air or stone pockets which may cause honey-combing, pitting, or planes of weakness. Use internal vibrators of the largest size and power that can properly be used in the work as described in ACI – 301, Table 5.3.2.5. Workers shall be experienced in use of the vibrators. Do not use vibrators to move concrete within the forms.
 7. Construction joints and other bonded joints – Locate construction joints as indicated on the Project Drawings or as accepted by the Architect/Engineer.
- C. Finishing formed surfaces – After removal of forms, give each formed surface (1) or more of the finishes as specified by the Architect/Engineer. Finishes are to be in accordance with ACI-301, Section 5.3.3.
- D. Finishing unformed surfaces – Place concrete at a rate that allows spreading, straight edging, and darbying or bull floating before bleed water appears. Strike smooth the top of walls, buttresses, horizontal offsets, and other similar unformed surfaces and float them to a texture consistent with finish of adjacent formed surface. Finish slab surfaces as specified by the Architect/Engineer. Finishes are to be in accordance with ACI-301. Flatness shall be $F_F = 20$ and Levelness shall be $F_L = 15$ unless noted otherwise in the Construction Documents and shall meet the requirements of ACI-117.

- E. Sawed control joints – Where saw cut joints are required or permitted, start cutting as soon as concrete has hardened sufficiently to prevent dislodgement of aggregates. Saw a continuous slot to a depth of one-fourth the thickness of the slab but not less than one inch. Complete sawing within (12) hours after placement.
- F. Curing and protection
 - 1. General – Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Protect concrete during the curing period such that the concrete temperature does not fall below the requirements of Section 2.03, Paragraph B, Sub Paragraph 6 – Concrete Temperature. Cure concrete in accordance with ACI-301, 5.3.6.2 or 5.3.6.3 for (7) days after placement.
 - 2. Formed concrete surfaces – Keep absorbent wood forms wet until they are removed. After form removal, cure concrete by (1) on the methods in Sub Paragraph 3 – Unformed Concrete Surfaces.
 - 3. Unformed concrete surfaces – After placing and finishing, use (1) or more of the following methods to preserve moisture in concrete:
 - a. Ponding, continuous fogging or continuous sprinkling.
 - b. Application of mats or fabric kept continuously wet.
 - c. Continuous application of steam (under 150° F).
 - d. Application of sheet materials conforming to ASTM C 171.
 - e. Application of a curing compound conforming to ASTM C 309. Apply the compound in accordance with manufacturer's recommendation after water sheen has disappeared from the concrete surface and after finishing operations. The rate of application shall not exceed 200 ft²/gal. For rough surfaces, apply in (2) applications at right angles to each other, not to exceed 200 ft²/gal. for each coat. Do not use curing compound on any surface where concrete or other material will be bonded unless the curing compound will not prevent bond or unless measures are to be taken to completely remove the curing compound from areas to receive bonded applications.
 - f. When the ambient temperature exceeds 90° F, either ponding, continuous fogging, continuous sprinkling or application of mats or fabric kept continuously wet are required for curing. Other methods of curing are not allowed.
- G. Repair of surface defects
 - General – Repair tie holes and surface defects immediately after form removal. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing. Repairs are to meet the requirement of ACI-301, Section 5.3.7.

END OF SECTION

SECTION 040511 - MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry and cast stone.

1.02 RELATED REQUIREMENTS

- A. Section 042613 - Masonry Veneer
- B. Section 047200 - Cast Stone Masonry

1.03 REFERENCE STANDARDS

- A. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2024.
- B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.
- C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2024.
- D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.
- E. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025.
- F. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025.
- G. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- H. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.
- I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: 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.
- C. Manufacturer's Certificate: Certify that products 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.

1.06 PRECONSTRUCTION TESTING

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 014000 - Quality Requirements.
- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.

1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.08 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- 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. Mortar Mix Designs: ASTM C270, Property Specification.
 1. Masonry below grade and in contact with earth: Type M.
 2. Exterior Masonry Veneer: Type N.
 3. Cast Stone: Type N.

2.02 MATERIALS

- A. 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: To be Selected by Architect
- B. Portland Cement: ASTM C150/C150M.
 1. Type: Type I - Normal; ASTM C150/C150M.
 2. Color: To be selected by Architect
- C. Masonry Cement: ASTM C91/C91M.
 1. Type: Type N; ASTM C91/C91M.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Quicklime: ASTM C5, non-hydraulic type.
- F. Mortar Aggregate: ASTM C144.
- G. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
- H. Water: Clean and potable.
- I. Bonding Agent: Latex type.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- D. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- E. Do not use anti-freeze compounds to lower the freezing point of mortar.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.

PART 3 EXECUTION

3.01 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Install mortar to requirements of section(s) in which masonry is specified.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 014000 - Quality Requirements.
- B. Test and evaluate mortar in accordance with ASTM C780 procedures.

END OF SECTION

SECTION 042223 - ARCHITECTURAL CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Split face concrete masonry units.
- B. Architecturally styled concrete masonry units.
- C. Shot blasted / weathered concrete masonry units.
- D. Glazed masonry concrete masonry units.

1.2 RELATED SECTIONS

- A. Section 033000 - Cast-in-Place Concrete
- B. Section 072100 - Thermal Insulation
- C. Section 076000 - Sheet Metal Flashing and Trim

1.3 REFERENCES

- A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
- B. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- C. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
- D. ASTM C1262 - Standard Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units
- E. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

1.4 DEFINITIONS

- A. CMU: Concrete Masonry Unit.
- B. Dimensions: All unit sizes are shown as Nominal Dimensions.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit under provisions of Section 013000.
- B. Product Data: Manufacturer's product information and data sheets for each product specified in this section, including:
 - 1. Substrate preparation instructions and recommendations.
 - 2. Installation means and methods.
 - 3. Recommendations and requirements for proper storage and handling.
- C. Shop Drawings:
 - 1. Submit Manufacturer's approved shop drawings detailing the section and elevation views of each product to be installed.
 - 2. Coordinate with locations listed on Contract Drawings.
 - 3. Reinforcing: Provide drawings indicating reinforcing that complies with ACI 315 "Details and Detailing of Concrete Reinforcement".
 - a. Provide elevations indicating steel reinforcing bar placement.
 - b. Provide details indicating steel reinforcing bar sizes, placement, bends, and laps dimensions.

- D. Warranty Information:
 - 1. Submit confirmation and details of manufacturer's warranty, extended warranty, and replacement policies.
- E. Submit product data for each type of product specified, including certification that each type complies with specified requirements.
- F. Submit sample boards, cards or charts depicting available textures and colors for each CMU and associated mortar.
- G. Mock-Up: Construct a mock-up using the selected stone and mortar materials to illustrate the appearance of the Work specified in this section.
 - 1. The mock-up should be a nominal 36 inches x 36 inches (1 m x 1 m).
 - 2. Construct the mock-up using the size, color blend, texture, joint size, and installation methods specified.
 - 3. Architect and Owner's Representative must approve the mockup prior to commencement of Work.

1.6 CLOSEOUT SUBMITTALS

- A. Submit under provisions of Section 017000.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials to the site on quality wooden pallets with appropriate in-plant packaging for safe transit and handling. Store pallets in single stacks on level ground and protect from weather.
- B. Deliver mortar materials in original unbroken, undamaged packages with labels intact and visible.
- C. Store materials covered and off the ground until used on the Work in this section.

1.8 WARRANTY

- A. Provide a copy of the project specific manufacturer's warranty which addresses the term of the warranty period (in years), the acceptable standards of production/performance and the agreed upon action for products that fail to meet the standards of production/performance within the specified warranty period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Echelon, An Oldcastle Company.
 - 1. Address: 3 Glenlake Pkwy, FL 12, Atlanta, GA 30328
 - 2. Phone: (844) 495-8211
 - 3. Website: www.echelonmasonry.com
- B. Substitutions:
 - 1. Submit substitution requests in accordance with provisions of Section 016000.
 - 2. Single manufacturer will provide, from a single source, the following components:

2.2 PERFORMANCE REQUIREMENTS

- A. Freeze-Thaw Resistance: Meet or exceed the requirements of ASTM C1262.
- B. Abrasion Resistance: Meet or exceed the requirements of ASTM C744.
- C. Adhesion: Meet or exceed the requirements of ASTM C744.
- D. Color Change: Meet or exceed the requirements of ASTM C744.
- E. Resistance to Crazing: Meet or exceed the requirements of ASTM C744.
- F. Fire Resistance: Rated up to (4) four hours.
- G. Integral Water Repellant: Concrete Masonry Units must include an integral water repellant admixture at the time of production.

2.3 CONCRETE MASONRY UNITS

- A. General / Appearance: Architectural ground face concrete block masonry units meeting the requirements of ASTM C90.
- B. General / Appearance: Pre-finished, architectural concrete block meeting the requirements of ASTM C90.
 - 1. Basis of Design Product: Trenwyth High Polish concrete masonry units, from Echelon.

2.4 FINISHES

- A. Color:
 - 1. Ground Face masonry unit – Natural
 - 2. Trenwyth High Polish concrete masonry unit – Architect shall select from manufacturers full color range
- B. Dimensions:
 - 1. Size, locations, and installation pattern as noted in the Contract Drawings.

2.5 MORTAR

- A. Provide pre-blended mortar that meets or exceeds the requirements of ASTM C1714/C1714M Type N.
- B. Provide pre-blended mortar that meets or exceeds the requirements of ASTM C1714/C1714M Type S.
- C. Mortar must include manufacturer approved compatible integral water repellent additive added to each batch in the dosage rates for mortar type specified.
- D. Color:
 - 1. Architect shall select from manufacturer's full color range.

2.6 MIXES

- A. Portland Cement: Conforming to ASTM C150 Type I, Type II or Type III as required to achieve optimal results based on ambient project conditions.
- B. Hydrated Lime: Conforming to ASTM C207, Type S.
- C. Aggregates: Conforming to ASTM C144 for mortar and ASTM C404 for grout.
- D. Pigments: Conforming to ASTM C979. Comply with quantity limitations in referenced standards and from the pigment manufacturer.

- E. Admixtures: Comply with quantity limitation specified ASTM C1384 "Standard Specification for Admixtures for Masonry Mortars" when adding to mortar.
 - 1. Cold Weather: Comply with ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
 - 2. Integral Water Repellant: Liquid polymeric, admixture that does not reduce flexural bond strength
 - a. Basis of Design Product: RainBloc® Water Repellent Masonry Unit admixture, manufactured by ACM Chemistries, Inc.
- E. Water: Potable; Clean and drinkable.

2.7 ACCESSORIES

- A. Provide coordinating accessory stones as necessary to achieve a complete installation as noted in the Contract Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are properly prepared to receive concrete masonry units.
- B. Verify that bearing elements are within tolerances conforming to the requirements of ACI 117.
- C. Verify that locations of penetrations, projections and built-in items are correct and properly prepared for work specified in this section.
- D. Verify concrete brick masonry units are according to project specification and meet appropriate ASTM specification requirements. Commencement of installation constitutes acceptance of Concrete Face Brick, Concrete Masonry Units, Concrete Masonry Veneers, and Concrete Thin Veneers.
- E. Preparation: Prepare surfaces and materials in accordance with MSJC Specifications for Masonry Structures. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
- E. Provide adequate lighting for masonry work by placing all lighting at a reasonable distance from the wall for even illumination.

3.2 PREPARATION

- A. Proceed with installation only after substrate(s) are been properly prepared and within tolerances recommended by the manufacturer.
- B. Commencement of installation constitutes acceptance of site conditions.
- C. Draw blocks from more than one pallet at a time during installation.

3.3 INSTALLATION

- A. Cutting: Make all unit cuts, including those for bonding, holes, boxes, etc., with motor-driven masonry saws, using either an abrasive or diamond blade. Cut neatly and locate for best appearance.
- B. Concrete Masonry Units:

1. Install concrete masonry units in accordance with industry accepted masonry practices and manufacturer's instructions.
 2. Bond Pattern: As indicated on Construction Drawings.
 3. Do not use masonry units with broken corners and edges in excess of ASTM C90 and ASTM C1634.
 4. Supporting and Forms: Construct forms as needed to adequately and safely support installed concrete masonry units until mortar has cured.
- C. Mortar Bedding and Jointing:
1. Lay units with full mortar coverage on head and bed joints taking care not to block cores to be grouted or filled with masonry insulation.
 2. Tool all joints into a concave configuration when mortar is thumbprint hard.
 3. Remove mortar from the face of masonry units before it sets.
 4. Tuckpoint joints of scored units for proper appearance and to prevent water penetration. Rake joints are not permitted and will be considered defective work.
- D. Flashing: Install flashing at locations shown in the plans and in strict accordance with Construction Drawings, manufacturer's instructions and accepted best practices for masonry flashing.
- E. Weeps and Vents: Install weep holes and vents at proper intervals at courses above grade and at any water stops over windows, doors and beams

3.4 FLASHING

- A. All flashing and accessory detailing components must be corrosion resistant.
- B. Verify that all flashing, including adjacent roof flashing, has been properly installed. Extend flashing material above horizontal terminations, roofing material, drainage planes or drainage products.
- C. Integrate all flashing materials with moisture resistive barriers to prevent water penetration into structure. Lap water resistive barriers over weep screed flanges in a water shedding fashion.
- D. Control Joints: Determine if and where Control joints are needed. Consideration should be given to where differential movement is expected or where movement may be concentrated. Refer to NCMA TEK 10-02C for guidance on control joint locations.

3.5 INSPECTION AND CLEANING

- A. Faces must conform to the requirements of ASTM C90 when viewed from twenty (20) feet at right angles to the wall with normal lighting.
- B. Keep work surfaces clean during installation. Use brushes, rags and burlap to remove excess mortar lumps and smears prior to hardening on the finished surfaces.
- C. Refer to Manufacturers recommendations for cleaning instructions for installed veneers.

END OF SECTION

SECTION 042613 - MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clay facing brick.
- B. Reinforcement and anchorage.
- C. Flashings.
- D. Installation of lintels.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 040511 - Masonry Mortaring and Grouting
- B. Section 054000 - Cold-Formed Metal Framing
- C. Section 079200 - Joint Sealants

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- H. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.
- I. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.
- J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2024.
- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- L. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.
- M. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.

- N. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025.
- O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.
- P. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- Q. ASTM C1405 - Standard Specification for Glazed Brick (Single Fired, Brick Units); 2020a.
- R. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- S. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.
- T. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- U. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units and mortar.
- C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories and structural backup in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.08 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 BRICK UNITS

- A. Manufacturers:
 - 1. Endicott Clay Products Co
 - 2. General Shale Brick
 - 3. Meridian Brick LLC
 - 4. Metro Brick
 - 5. Belden Brick Compa
 - 6. Boral Bricks, Inc; Boral Limited
 - 7. Glen-Gery Corporation
 - 8. Substitutions: See Section 016000 - Product Requirements.
- B. Facing Brick: ASTM C216, Type FBX, Grade SW.
 - 1. Color and texture to match Architect's sample.
 - 2. Color and Texture: To be selected by the Architect.
 - 3. Nominal Size: 4 inches wide by 2 2/3 inches high by 8 inches long.
 - 4. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 - 5. Initial Rate of Absorption: Less than 30g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
 - 6. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
- C. Thin Brick Veneer: ASTM C 1088, Grade Exterior , Type TBX
 - 1. Color and Texture: To Match Facing Brick.

2.02 MORTAR MATERIALS

- A. Mortar: As specified in Section 040511.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches.

2.04 FLASHINGS

- A. Metal Flashing: Provide metal flashing complying iwth SMACNA's "Architectural Sheet Metal Manual" and as follows:

B. Metal Flashing Materials:

1. Copper Flashing: ASTM B370, H00 eighth hard, cold-rolled; 20 oz/sq ft thick; natural finish.
2. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.

C. Combination Asphaltic Flashing Materials - Copper:

D. Combination Non-Asphaltic Flashing Materials - Copper:

1. Copper/Polymer Film or Fabric Flashing: 3 oz/sq ft copper sheet laminated between two sheets of polymer or fiberglass fiber-reinforced film.
 - a. Manufacturers:
 - 1) Advanced Building Products, Inc; www.advancedbuildingproducts.com/#sle.
 - 2) Hohmann & Barnard, Inc; www.h-b.com/#sle.
 - 3) York Manufacturing, Inc; Multi-Flash 500 Series: www.yorkmfg.com/#sle.
 - 4) STS Coatings, Inc.
 - 5) Wire-Bond
2. Copper/Polymer Fabric Drainage Plane Flashing System: 3 oz/sq ft copper sheet bonded with rubber-based adhesive between one sheet of polymer fabric and one sheet of non-woven drainage material.

E. Combination Non-Asphaltic Flashing Materials - Stainless Steel:

1. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
2. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner on one side and a sheet of non-woven drainage material bonded to the other side.

F. Factory-Fabricated Flashing Corners and Ends: Stainless steel.

G. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

H. Termination Bars: Stainless steel; compatible with membrane and adhesives.

I. Drip Edge: Stainless steel; compatible with membrane and adhesives.

J. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.05 ACCESSORIES

- A. Preformed Control Joints: Polyvinyl chloride material. Provide with corner and tee accessories, fused joints.

- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- C. Weeps:
 - 1. Type: Molded PVC grilles, insect resistant.
 - 2. Color(s): As selected by Architect from manufacturer's full range.
- D. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 - 1. Mortar Diverter: Panels installed at flashing locations.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

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 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. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.
- 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. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

- A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

3.05 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Ties and anchors extend at least 1 1/2 inches into veneer but with at least 5/8 inch cover on outside face.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.07 CONTROL AND EXPANSION JOINTS

- A. Install expansion-joint material in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Do not continue horizontal joint reinforcement through control or expansion joints.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D. Size control joints as indicated on drawings; if not indicated, 3/8 inch wide and deep.

3.08 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.09 CUTTING AND FITTING

- A. Cut and fit for pipes and conduit. 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.

3.10 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.

- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.11 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 047200 - CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.
- B. Architectural synthetic stone units.
- C. Units required are indicated on drawings as "cast stone".

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
- D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.
- E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2019, with Editorial Revision (2020).
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025.
- J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- K. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.
- L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- M. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2023, with Editorial Revision (2024).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
 - 1. Include one copy of ASTM C1364 for Architect's use.

- 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.
- F. Full-Size Samples, For Review:
 - 1. Basic Shapes: One of each.
 - 2. Accent, Trim and Specialty Shapes: One of each.
- G. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

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. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UPS

- A. Provide full size cast stone components for installation in mock-up of exterior wall.
- B. See Section 014000 - Quality Requirements for additional requirements.
- C. Approved mock-up will become standard for appearance and workmanship.
- D. Mock-up may remain as part of the completed work.
- E. Remove mock-up not incorporated into the work and dispose of debris.

1.07 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 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural stone, complying with ASTM C1364.
 - 1. Compressive Strength complying with ASTM 1194: 6,500 psi minimum at 28 days.
 - 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. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 - 1. 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.
 - 2. 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 CODE-318.

2.02 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, Grade 40 (40,000 psi), 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: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.
- 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. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. 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 TOLERANCES

- A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
 - 1. Rake mortar joints 3/4 inch for pointing.
 - 2. Remove excess mortar from face of stone before pointing joints.
 - 3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
 - 4. Leave the following joints open for sealant:
 - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
 - b. Joints in projecting units.
 - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
 - d. Joints below lugged sills and stair treads.
 - e. Joints below ledge and relieving angles.
 - f. Joints labeled "expansion joint".
- B. Installation Tolerances:
 - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
 - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.

3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
- B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
- C. Repair methods and results subject to Architect 's approval.

3.05 CLEANING

- A. Keep cast stone components clean as work progresses.

3.06 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

PART 1 GENERAL

1.01 DESCRIPTION

- A. All work under this Section shall be performed entirely under one sub-contract, the scope of which shall include the production of shop drawings, the fabrication of all steel members and the erection of all structural and miscellaneous steel members.
- B. Work is to include all structural steel framing members, support members, with required bracing welds, fasteners, base plates, bearing plates, anchor bolts, and miscellaneous structural steel items.

1.02 APPLICABLE STANDARDS

- A. American Institute of Steel Construction
 - 1. AISC Manual of Steel Construction
- B. American Society for Testing and Materials:
 - 1. ASTM A 36 for steel plates
 - 2. ASTM A992 Grade 50 for Hot-Rolled Shapes
 - 3. ASTM A233 Class E70XX series electrodes for manual arc welding and Grade SAW-1 submerged arc processed shall be used
 - 4. ASTM F1554 (Grade 36) for column anchor bolts
 - 5. ASTM A325 for high strength bolts
 - 6. ASTM C827 for non-shrink and non-metallic grout
 - 7. ASTM C191 for non-shrink and non-metallic grout
 - 8. ASTM A500, Grade B structural tubing
 - 9. ASTM A501 steel pipe
- C. American Welding Society
 - 1. AWS D1.1 Steel stud shear connectors
- D. The Society for Protective Coatings
 - 1. Specifications SSPC Paint 25

1.03 QUALITY ASSURANCE

- A. A recognized testing laboratory approved by the Architect and Structural Engineer is to do the specified inspection and furnish to the Architect and Structural Engineer, reports of all inspections with complete summary of results. The Contractor shall coordinate all work required of the testing laboratory. Also see Section 01410 - TESTING LAB SERVICES.
- B. The testing laboratory shall visually inspect all field welds and all bolted connections for compliance with the details shown on the Plans and the requirements of the AISC.
- C. The testing laboratory shall use Ultrasonic Testing on 10% of all field welds.

- D. The Owner reserves the right to employ an independent testing laboratory to gamma ray or magna-flux all welds. Any welds found to be inadequate shall be removed and replaced by the Contractor at no additional cost to the Owner.
- E. Welds shall be made according to requirements of the American Welding Society. Welders shall be certified for this project as qualified structural welders according to the requirements of the American Welding Society by an independent testing laboratory approved by the Architect. Copies of current certificates for each field welder shall be furnished to the Architect.
- F. Mill certificates for all structural steel are to be available to the Architect for his review.

1.04 SUBMITTALS

- A. The fabricator shall furnish shop drawings as required by the contract documents showing all details necessary for erection and fabrication of his work to the Architect for his approval. Reproductions of the contract structural drawings for erection plans and details will not be permitted without the approval of the Engineer. Detailing shall be performed by experienced detailers. Erection plans, erection details, and detailing shall be clear and easily readable. If it is apparent to the Architect or Structural Engineer that the Contractor has not thoroughly checked the shop drawings prior to submittal, the Contractor will be notified to resubmit a set that has been properly checked, and the previous submittal will be abandoned. Only complete sets of shop drawings will be reviewed unless an agreement to check partial submittals is obtained prior to the first submittal. Do not fabricate any material until approval of the Architect has been obtained.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural steel shall be new sections that conform to the current Specifications of ASTM A-992, Grade 50.
- B. High strength bolts shall conform to ASTM Specification A325-N.
- C. Welds shall be E70XX Series electrodes for manual arc welding and grade SAW-1 for submerged arc process.
- D. All column anchor bolts shall be ASTM A325 (Group A).
- E. All bolts not indicated otherwise on plans are $\frac{3}{4}$ ". All connections not noted otherwise on plans shall be framed connections.
- F. Shear connectors shall be $\frac{3}{4}$ " diameter x 4" headed studs conforming to the requirements of AWS D1.1.
- G. Grout for base plates shall be precision, pre-mixed, non-shrink and non-metallic in conformance with ASTM C827. Grout shall be easily workable as well as being made flowable with an initial setting time of not less than 45 minutes and shall meet the requirements of ASTM C191. Grout shall have a 14 day compressive strength of 6000 psi when mixed to its flowable state.

- H. All structural steel shall be shop painted, surfaces to be painted shall be prepared per the Society for Protective coatings SSPC-SP3 or better.

Paint shall be per SSPC Paint 25, Tnemec Primers Series 10 – 99 or approved equal.

Field painting of work under this heading is specified in Section 09900, Paints and Coatings.

Where sprayed on fire-proofing is specified steel shall not be primed unless required by the fire-proofing manufacturer. If primer is required for fire-proofed steel, it shall be suitable to the fireproofing manufacturer for proper adhesion.

- I. Galvanizing:

Provide a zinc coating for those items shown or specified to be galvanized as follows:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.
3. ASTM A 386 for galvanizing assembled steel products.
4. ASTM A 446, Grade 90 for sheet steel.

PART 3 EXECUTION

3.01 FABRICATION

- A. All workmanship shall be equal to the best practice in modern structural shops. As a minimum required all structural steel work shall conform to the specifications of "American Institute of Steel Construction" (AISC).
- B. The fabricator shall design all simple wide flange beam connections to resist one half of the MAXIMUM TOTAL UNIFORM LOAD as provided in Table 3-6 of the AISC Steel Construction Manual.
- C. Shop connections shall be welded. Field connections shall be bolted unless welded connections are indicated on plans. Welded connections shall be detailed consistent with requirements of the American Welding Society. Bolted connections shall be proportioned as shown in AISC Manual, using minimum 3/4" A325 high strength bolts unless shown otherwise on plans.
- D. Shop and field welders shall have been recently certified as qualified structural welder according to requirements of the American Welding Society.
- E. Any splices not shown on the drawings shall be indicated clearly on the shop drawings and shall be made only with the approval of the Architect and/or Engineer.
- F. The general contractor is to verify the sizes and locations of all required floor and roof openings, equipment supports, etc. with the various subcontractors. Any conditions which require revisions or additions to the structural framing are to be brought to the attention of the Architect and Structural Engineer prior to any construction. Any cost for the required structural changes will be borne by the General Contractor.
- G. Unless otherwise detailed on the Plans, the fabricator shall design the frames for floor openings for the appropriate live and dead loads plus the weight of any mechanical or electrical equipment, ducts, pipes, etc.

- H. If a member size has been inadvertently omitted from the Plans, the fabricator shall contact the Structural Engineer for the required size prior to submittal of his bid proposal.
- I. Erection marks shall be painted on all structural members.
- J. Provide all necessary erection clips, angles, seats, etc., to properly erect structural steel.
- K. Welding shall be in accordance with the requirements of the American Welding Society with all possible welding performed in the shop.
- L. Provide one shop coat of paint to all structural members, connectors, angles, etc. Thickness shall be at least 1 mil dry film. All steel shall have been power wire brushed so as to remove all loose mill scale, rust, weld slag, etc., prior to painting.
- M. Fabricator shall obtain written approval from the manufacturer or applicator or any specified sprayed-on-fire-proofing material that the paint to be used for the shop coat is suitable for the adhesion of the sprayed-on material and a copy of same shall be submitted to the Architect.
- N. The Contractor shall make measurements in the field to verify or supplement dimensions shown on the drawings, and he shall be responsible for proper measurements and fit of all items.
- O. Over masonry openings for windows, doors, ducts, grilles, louvers, recesses in masonry walls, and where indicated or required, provide structural steel angles, channels, and shapes to properly support adjacent work. Where loose lintel angles occur in pairs, they shall have bolts and separators.
- P. For those galvanized items, apply a high zinc dust content paint for re-galvanizing welds in galvanized steel, complying to the Military Specification MIL-P-21035 (Ships).

3.02 ERECTION

- A. Provide false work, temporary bracing, and all tools, machinery and appliances, necessary for the expeditious handling of the work. False work and temporary bracing shall be properly designed and substantially constructed and maintained for the loads which will come upon it and shall remain in place until all permanent bracing is in place.
- B. Bolts shall be installed using a plain hardened steel washer fabricated in accordance with ASTM F436-11 under the turned element and shall be tightened as per the requirements of the AISC.
- C. The structural system and the individual structural members are designed to be self supporting only after all structural members are connected in place.
- D. Steel furnished shall be true and free of twists, bends, and open joints between components parts. Material shall be thoroughly straightened in the shop before being laid out or worked in any way.
- E. Each piece or member shall be properly identified by a mark and direction of setting. Contractor shall check each piece of conformity to plans and dimensions to maintain proper location, alignment and level.

- F. All members shall be set plumb and true to exact level, or slope if required, and checked by instrument. Grout base plates solidly with approved non-shrinking grout. Set bearing plates in mortar consisting of Portland Cement and sand.
- G. After erection, nuts, bolt heads, and burs or abraded spot shall be spot painted with above mentioned paint.
- H. Shear connectors are to be equally spaced, are to be welded through the deck to all interior beams, and may be welded directly to exterior beams.

END OF SECTION

SECTION 052100 - STEEL JOISTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Open web steel joists, with bridging, attached bearing plates, angles, and anchors.

1.02 APPLICABLE STANDARDS

- A. ASTM A307 Carbon Steel Threaded Standard Fasteners.
- B. ASTM A325 High Strength Bolts for Structural Steel Joints.
- C. AWS D1.1 Structural Welding Code.
- D. SJI Standard Specifications for Open Web Steel Joists K-Series, and Standard Specifications for Long Span Steel Joists LH-Series and Deep Long Span Steel Joists DLH-Series.
- E. Steel Structures Painting Council Specification.

1.03 QUALITY ASSURANCE

- A. Conform to SJI Standard Specifications, Load Tables, and Weight Tables.

1.04 SUBMITTALS

- A. The fabricator shall submit, before any fabrication, five (5) copies of shop drawings for the approval of the Architect. The shop drawings shall indicate standard designations, configuration, sizes, spacing, and locations of joists, joist coding, bridging, connections, attachments, cambers, and elevations.

1.05 PRODUCT HANDLING

- A. Deliver, store and handle steel joist as recommended in SJI specifications. Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Open Web Joist Members: SJI Type K and LH Open Web and SJI Type LH Open Web.
- B. Anchor Bolts, Nuts and Washers: ASTM A325.
- C. Primer: SSPC 15, Type 1 red oxide or equal.

2.02 FABRICATION

- A. Fabricate steel joists in accordance with SJI Standard Specifications including headers and other supplementary framing.

- B. Provide bottom and top joist chord extensions indicated.
- C. Prepare and shop prime with one (1) coat of primer.
- D. Camber Joist per SJI recommendations.
- E. End bearing plates shall be shimmed to provide uniform bearing where sloping joists rest on top of beam flanges, and slope exceeds one-fourth inch per foot and is less than three-fourths inch per foot. Where slope exceeds three-fourths inch per foot, bearing plates shall be sloped.
- F. The ends of steel joists shall extend a distance of not less than four (4) inches over masonry or poured concrete supports. The ends of joists shall extend not less than 2-1/2 inches over steel supports except where opposite joists butt over a narrow steel support. Positive attachment to the support is to be made by welding or bolting in accordance with the requirements of SJI.
- G. Top and bottom chord of joists shall be bridged with steel angles welded to the top of the bottom chord and to the bottom of the top chord of each joist. The alignment of the continuous bridging shall be straight and true as bridging butts into beam, wall, etc., and it shall be positively attached in an approved manner. Spacing of bridging shall be in accordance with Steel Joist Institute Specifications or as indicated on the drawings.

PART 3 EXECUTION

3.01 ERECTION

- A. Erect steel joists in accordance with SJI Standard Specifications.
- B. Bear joists on supports in accordance with SJI.
- C. During erection, provide temporary bracing for induced loads and stresses.
- D. Coordinate placement of anchorages in masonry construction for securing to bearing member.
- E. Field weld joist seat to placed bearing member after alignment.
- F. Where bridging is not indicated on the plans it is to be provided in accordance with the requirements of the SJI.
- G. Do not permit erection of decking until joists are braced and bridged.
- H. Do not field cut or alter joists without approval of the Architect/Engineer.
- I. After erection, prime welds, abrasions, and surfaces not primed. Use primer consistent with shop coat.

END OF SECTION

SECTION 053113 - STEEL COMPOSITE FLOOR DECK

PART 1 GENERAL

1.01 DESCRIPTION

- A. Floor decking shall be 2" composite steel floor form.

1.02 REFERENCES

- A. AIS - Specification for the Design of Cold-Formed Steel Structural Members.
- B. ASTM A36 - Structural Steel.
- C. ASTM A525 - Steel sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process G60 Coating Class.
- D. ASTM A446 - Steel, Cold-Rolled Sheet, Carbon, Structural.
- E. AWS D1.1 - Structural Welding Code.
- F. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.

1.03 SUBMITTALS

- A. The fabricator shall furnish and submit before any fabrication, five (5) copies of shop drawings (erection and fabrication) of his work for the approval of the Architect. One (1) copy of each sheet will be returned marked for corrections or as approved. Copies of approved drawings shall be furnished the job as needed, and one (1) complete set given the Architect.

1.04 PRODUCT HANDLING

- A. Steel deck shall be stored off the ground with one (1) end elevated to provide drainage and shall be protected from the elements with a waterproof covering, ventilated to avoid condensation.
- B. Exercise care to control traffic and storage of materials on deck. Erected deck shall be planked or otherwise protected against damage from workers walking on material, heavy construction traffic and storage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Metal Floor Deck:
 - 1. Steel floor deck shall be cold formed corrugated steel with a minimum yield strength of 40,000 psi. Sheets shall be galvanized conforming to ASTM A525, G60 coating class. Composite deck shall be 20 ga. and shall have the following minimal structural properties:

$$I_p: 0.417 \text{ in}^4 / \text{ft.}$$

I_n : 0.412 in⁴ / ft.
 S_p : 0.342 in³ / ft.
 S_n : 0.347 in³ / ft.

2. All accessory items necessary for a complete installation, such as cover plates, closures, etc., whether specifically indicated in the specifications or on the drawings, shall be furnished by the deck manufacturer.
3. The delivered thickness of the uncoated steel shall not be less than 95% of the design thickness.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Deck sheets shall be welded to supporting steel immediately after alignment using welding washers.

Mechanical fasteners may be substituted for puddle welds. The Contractor shall provide documentation from the mechanical fastener manufacturer as to the equivalent load capacity and proper installation procedure for each type of fastener being used.

- B. On steel support members provide 3 inch minimum bearing. Align and level on supports. Deck shall be side-lapped and span over a minimum of three (3) supports, lapping a minimum of 2" at a supporting member.
- C. Fasten side laps in accordance with manufacturer's recommendation.
- D. Floor deck shall be fastened to supporting members at all edge ribs plus a sufficient number of interior ribs to provide a maximum average spacing of 12". The maximum spacing between adjacent points of attachment shall not exceed 18".
- E. Reinforce deck openings from 6 to 18 inches in size with 2 x 2 x 1/4 inch steel angles. Place angles perpendicular to flutes; extend minimum two (2) flutes each side of opening and weld to deck.
- F. Install 6 inch wide sheet steel covers where deck changes direction. Spot weld in place 12 inches o.c. maximum.
- G. Under no condition will placed sheets be left unattached at the end of a working day.
- H. Deck is to be continuous over a minimum of two (2) spans or one (1) line of temporary shoring is to be provided at the mid span of deck. Shoring is to be in place prior to pouring the concrete slab it supports and is to remain in place for a minimum of 15 days and until the concrete has attained 85% of its specified 28 day strength.

END OF SECTION

SECTION 053123 – STEEL ROOF DECK

PART 1 GENERAL

1.01 DESCRIPTION

- A. Roof deck is to be galvanized steel Type “B” deck.

1.02 REFERENCES

- A. AISI – Specification for the Design of Cold-Formed Steel Structural Members.
- B. ASTM A36 – Structural Steel.
- C. ASTM A525 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process G60 Coating Class.
- D. ASTM A446 – Steel, Cold-Rolled Sheet, Carbon, Structural.
- E. AWS D1.1 – Structural Welding Code
- F. SDI – Design Manual for Composite Decks, Form Decks, Roof Decks.

1.03 SUBMITTALS

- A. The fabricator shall furnish and submit before any fabrication, five (5) copies of shop drawings (erection and fabrication) of his work for the approval of the Architect. One (1) copy of each sheet will be returned marked for corrections or as approved. Copies of approved drawings shall be furnished the job as needed, and one (1) complete set given the Architect.

1.04 PRODUCT HANDLING

- A. Steel deck shall be stored off the ground with one (1) end elevated to provide drainage and shall be protected from the elements with a waterproof covering, ventilated to avoid condensation.
- B. Exercise care to control traffic and storage of materials on deck. Erected deck shall be planked or otherwise protected against damage from workers walking on material, heavy construction traffic and storage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel deck shall be 1 ½” deep, 22 gage, Type B galvanized metal deck having the following minimal sectional properties:

I_p : 0.155 in⁴/ft.

I_n : 0.183 in⁴/ft.

S_p : 0.186 in³/ft.

S_n : 0.192 in³/ft.

Steel deck shall be manufactured from steel conforming to ASTM Designation A1008-00, Grades C, D, or E or A653/A653M-00, Grade SQ33 or higher, or equal, having a minimum yield strength of 33,000 pounds per square inch. The maximum working stress shall not exceed 20,000 pounds per square inch. The unit design stress shall in no case exceed the minimum yield strength of the steel divided by 1.65 for specific design uniform loads. The thickness of 22 gage steel before coating shall be 0.0295" for design thickness and 0.028" for minimum thickness.

- B. All accessory items necessary for a complete installation, whether specifically indicated in the specifications and/or drawings shall be furnished by the roof deck manufacturer.
- C. The delivered thickness of the uncoated steel shall not be less than 95% of the design thickness.
- D. Where possible sheets shall rest on four (4) supports (three span condition).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Attachments:
 - 1. Steel deck units shall be anchored to supporting members, including bearing walls, to provide lateral stability to the top flange of the supporting structural members.
 - 2. Steel decks shall be attached to supporting structural members using a 36/7 pattern with No. 12 – 14 HWH TEK 1 screws when the maximum base metal thickness (support and deck) is less than or equal to 0.210". Where the base metal thickness falls within a range of 0.211" and 0.500", the deck shall be attached to supporting members using a No. 12 – 24 HWH TEK 5 screws. Screws shall have the following minimum allowable capacities: shear capacity of 176 lbs, pullover 295 lbs, and pullout capacity 74 lbs. Powder-actuated deck fasteners are acceptable as a substitute for TEK screws provided the allowable capacities are achieved.
 - 3. Unless noted otherwise on Structural drawings, sides laps are not required. However, side laps are required for spans greater than 5 feet, side laps shall be fastened together using a No. 10-16 HWH TEK 3 at a maximum spacing of 3 feet center-to-center between supports.
- B. All steel to be used for roof deck shall be free of oil, grease, and dirt, and shall be galvanized.
- C. Deck sheets will be placed in accordance with approved erection layout drawing supplied by the deck manufacturer and in conformance with the deck manufacturer's standards. Roofs having a slope of 1/4" or more in 12 inches shall be erected beginning at the low side to ensure that end laps are shingle fashion. End laps of sheets shall be a minimum of 2 inches and shall occur over supports. Openings not shown on the erection diagrams, such as those required for stacks, conduits, plumbing, vents, etc., shall be cut (and reinforced, if necessary) by the trades requiring the openings.
- D. Under no conditions will placed sheets be left unattached at the end of a working day.

END OF SECTION

SECTION 05 41 00 - COLD FORMED METAL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY:

Extent of cold-formed metal framing is shown on drawings.

Types of cold-formed metal framing units include the following:

"C" shaped load-bearing steel studs.

"C" shaped steel joists.

"Z" shaped steel purlins

1.03 SUBMITTALS:

Product Data: Submit manufacturer's product information and installation instructions for each item of cold-formed metal framing and accessories.

Shop Drawings: Submit shop drawings that have first been checked and approved of by the contractor. These drawings shall be sealed and signed by the professional engineer responsible for the design. They shall include placing drawings for framing members showing size and gage designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

1.04 QUALITY ASSURANCE:

Design: The cold-formed metal supplier shall retain, at his expense, the services of a Professional Engineer registered in the state of Louisiana who is fully familiar and experienced in the design of this type of load bearing, light gauge metal framing. The Engineer is to design the light gauge metal members indicated on the plans for the loads required in the latest edition of ASCE-7 per the latest edition of the International Building Code or as indicated on the plans, plus applicable dead loads. The Engineer's design will also include the design of lateral force resisting systems where indicated on the structural drawings. The Engineer's design will also include any additional members required for a complete installation, including the design of all necessary connections between light gauge members and other structural components.

The horizontal deflection on all wall studs shall be limited to $H/360$ except those studs providing backup up for masonry veneer which shall have a limited deflection of $H/600$.

The engineer shall also make a trip to the job site to meet with the architect, contractor and light gauge metal subcontractor to inspect the fabrication and erection of the cold-formed metal framing.

All design, fabrication and erection are to be in accordance with A.I.S.I. specification for the Design of Cold-Formed Steel Structural Members, latest edition.

Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, Structural Cold Formed Metal Framing (Performance Spec) (Load Bearing)

Welding Code - Sheet Steel.

Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing authorities having jurisdiction.

DELIVERY, STORAGE AND HANDLING: Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with breathable waterproof tarpaulins.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Bostwick Steel Framing Co.
Consolidated Systems, Inc.
Marino Industries Corp.
U.S. Gypsum Co.
Clark Dietrich Building Systems

METAL FRAMING:

System Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide a complete metal framing system.

Materials and Finishes:

For 16-gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 50,000 psi; ASTM A 446, A 570, or A 611.

For 18-gage and lighter units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 446, A 570, or A 611.

Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 coating.

Finish of installation accessories to match that of main framing components, unless otherwise indicated.

"C" Shape Studs: Manufacturer's standard load-bearing steel studs of size, shape, and gage indicated, with 1.625" flange and flange return lip.

Joists: Manufacturer's standard C-shape section of size, shape, and gage indicated.

Electrodes for Welding: Comply with AWS Code.

Galvanizing Repair Paint: High zinc dust content paint for repair of galvanized surfaces damaged by welding, complying with M. I. Spec. MIL-P-21035.

2.02 FABRICATION:

General: Framing components may be pre-fabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of pre-fabricated panels in a manner to prevent damage or distortion.

Fabricate panels in jig templates to hold members in proper alignment and position and to assure consistent component placement.

Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

Wire tying of framing components is not permitted.

Fabrication Tolerances: Fabricate panels to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8" in 10'-0".

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION:

Pre-Installation Conference: Prior to start of installation of metal framing systems, the Architect, General Contractor, the Metal Framing Subcontractor, and the Structural Engineer for the Cold-Formed Metal Supplier will meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

INSTALLATION:

Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.

Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, or 16" o.c. for other types of attachment or provide fasteners as indicated on the drawings.

Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

Install supplementary framing blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

Installation of Wall Stud System: Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.

Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where More than 2 are either shown or indicated in manufacturer's instruction. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.

Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 3'-0" o.c. Weld at each intersection.

Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true to line joints.

Step in face and jog in alignment between panels not to exceed 1/16".

Installation of Joists: Install level and plumb, complete with bracing and reinforcing as indicted on drawings. Provide not less than 1-1/2" end bearing.

Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section, end grain wood block, Or as otherwise recommended by joist manufacturer.

Where required, reinforce joists at interior supports with single short length of joist section located Directly over interior support, snap-on shoe, 30% side-piece lapped reinforcement, or other method Recommended by joist manufacturer.

Secure joists to interior support systems to prevent lateral movement of bottom flange.

Field Painting: Touch-up shop-applied protective coatings damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION

SECTION 055100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stairs with concrete treads.
- B. Structural steel stair framing and supports.
- C. Handrails and guards.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.
- 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; 2023.
- J. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.
- K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.
- L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

- M. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- O. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Design Data: As required by authorities having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications:
 - 1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
 - 2. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure. Avoid the use of columns, attaching to building structure is preferred.
 - 1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
 - 2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
 - 3. Structural Design: Provide complete stair and railing assemblies that comply with the following:

- a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
 - b. Railing Assemblies: Comply with applicable local code.
- 4. Dimensions: As indicated on drawings.
- 5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
- 6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
- 7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
 - 1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
 - a. Welded Joints: Continuously welded and ground smooth and flush.
 - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
 - c. Exposed Edges and Corners: Eased to small uniform radius.
 - d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

- A. Jointing and Finish Quality Level: Architectural, as defined above.
- B. Risers: Closed.
- C. Treads: Metal pan with field-installed concrete fill.
 - 1. Concrete Depth: 1-1/2 inches, minimum.
 - 2. Tread Pan Material: Steel sheet.
 - 3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
 - 4. Concrete Reinforcement: Welded wire mesh.
 - 5. Concrete Finish: For resilient floor covering.
- D. Risers: Same material and thickness as tread pans.
 - 1. Nosing Depth: Not more than 1-1/2 inch overhang.
 - 2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.
- E. Stringers: Rolled steel channels.
 - 1. Stringer Depth: 10 inches.
 - 2. End Closure: Sheet steel of same thickness as risers welded across ends.
- F. Railings: Steel pipe railings.
- G. Finish: Shop- or factory-prime painted.

2.03 HANDRAILS AND GUARDS

- A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
 - 1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
- B. Guards:
 - 1. Top Rails: Round pipe or tube rails unless otherwise indicated.
 - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
 - 2. Infill at Picket Railings: Vertical pickets.
 - a. Horizontal Spacing: Maximum 4 inches on center.
 - b. Material: Solid steel bar.
 - c. Shape: Square.
 - d. Size: 1/2 inch square.
 - e. Top Mounting: Welded to underside of top rail.
 - f. Bottom Mounting: Welded to top surface of stringer.
 - 3. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
 - a. Outside Diameter: 1 inch.
 - b. Material: Steel pipe or tube, round.
 - c. Vertical Spacing: Maximum 4 inches on center.
 - d. Jointing: Welded and ground smooth and flush.
 - 4. End and Intermediate Posts: Same material and size as top rails.
 - a. Horizontal Spacing: As indicated on drawings.
 - b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
 - 1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
 - 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
- E. Concrete Reinforcement: Mesh type as detailed, galvanized.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- F. Obtain approval prior to site cutting or creating adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 057311 - DECORATIVE METAL AND GLAZED METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Railing and handrail assemblies.
- B. Structural glass railings.

1.02 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- D. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- J. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- L. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).
- M. ICC-ES ESR-4405 - Evaluation Report for Shoe Glass Panel Railing System; 2022, with Editorial Revision.
- N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
 - 1. Contractor.
 - 2. Manufacturer's representative.
 - 3. Architect.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, and finishes.
- C. ICC Certification: Submit documentation from manufacturer showing specified systems comply with ICC-ES ESR-4405.
- D. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, transitions, and terminations.
- E. Samples: Submit one (1) of each item below for each type and condition shown.
 - 1. Glass: 12 inches by 12 inches, showing color, thickness and edge condition.
 - 2. Railing: 12-inch long section of handrail showing color, finish and connection detail.
 - 3. Cladding: 6-inch by 6-inch sample of each type of cladding, showing finish.
- F. Manufacturer's qualification statement.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing decorative railing systems and acceptable to manufacturer.

1.06 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide mock-up of railing system, 4 feet long by 4 feet wide, indicating each type of material, cladding, and finish.
- C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in factory-provided protective coverings and packaging.
- B. Protect materials against damage during transit, delivery, storage, and installation at site.
- C. Inspect materials upon delivery for damage. Replace damaged items.
- D. Prior to installation, store materials and components under cover in a dry location.

1.08 FIELD CONDITIONS

- A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.
- B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

1.09 WARRANTY

- A. Warranty: Manufacturer's standard one-year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 STRUCTURAL GLASS RAILINGS

- A. Structural Glass Railing System, Base-Mounted: Engineered, base-shoe supported railing system with structural glass.
 - 1. Product:
 - a. Viva Railings, LLC; SHOE Railing System: BASIS OF DESIGN
 - b. Stainless Fabricators Inc.
 - c. P & P Artec
 - d. HDI
 - e. Substitutions: See Section 016000 - Product Requirements.
 - 2. Top Rail: U-shaped top cap, stainless steel.
 - 3. Grip Rail: Round, stainless steel, 1-1/2 inch diameter.
 - 4. Handrail Brackets: Same metal as railing.
 - 5. Base Shoe, Aluminum: ASTM B221 or ASTM B221M, 6063 alloy, T5 temper; rectangular profile and factory-applied finish.
 - 6. Base Cladding: 18 gauge, 0.0500 inch stainless steel; No.6 satin finish.
 - 7. Glass: As specified in this section.
 - 8. Fasteners:
 - a. Attachment to Steel: Provide 24-inch center-to-center hole spacing; 1/2-inch, stainless steel, socket head cap screws for drilled and tapped or drilled and bolted attachment.

2.02 MATERIALS AND FINISHES

- A. Aluminum Components: ASTM B221 or ASTM B221M.
- B. Stainless Steel Components:
 - 1. ASTM A666, Type 304 or Type 316.
 - 2. Stainless Steel Tubing: ASTM A554, Type 304 or Type 316.
 - 3. Stainless Steel Bars, Shapes, and Moldings: ASTM A276/A276M, Type 304 or Type 316.
 - 4. Stainless Steel Finish: No.6 Satin.
- C. Glass:
 - 1. Fully Tempered Safety Glass: ASTM C1048; Condition A, Type 1, transparent, Class 1, Quality Q3, unless otherwise indicated.
 - a. Plastic Interlayer: SGP, 0.060 inch thick.

- b. Impact Strength: Category II, tested in accordance with 16 CFR 1201.
- c. Thickness: 1/2 inch.
- d. Configuration: As indicated on drawings.
- e. Edges: Ground smooth and polished.
- f. Finish: Plain, no finish.
- g. Color: Clear, no tint.

2.03 ACCESSORIES

- A. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable, provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to cast into concrete for bolt anchors.
 - 2. For anchorage to masonry, provide brackets to embed in masonry for bolt anchors.
 - 3. For anchorage to stud walls, provide backing plates for bolt anchors.
 - 4. Exposed Fasteners: No exposed bolts or screws.
- B. Carbon Steel Bolts and Nuts: ASTM A307.
- C. Hydraulic Expansion Cement: ASTM C1107/C1107M.
- D. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.
- E. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015 inch dry film thickness per coat.
- F. Sealant: Silicone; black.
- G. Finish Touch-Up Materials: As recommended by manufacturer for field application.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, comply with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and site conditions are acceptable and ready to receive work.
- B. Verify field dimensions of locations and areas to receive work.
- C. Notify Architect immediately of conditions that would prevent satisfactory installation.
- D. Do not proceed with work until detrimental conditions have been corrected.
- E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

- A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.
- B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

- A. Comply with manufacturer's drawings and written instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.
- C. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Anchor securely to structure.
- E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- F. Weld connections that cannot be shop welded due to size limitations.
 - 1. Weld in accordance with AWS D1.1/D1.1M.
 - 2. Weld stainless steel in accordance with AWS D1.6/D1.6M.
 - 3. Match shop welding and bolting.
 - 4. Clean welds, bolted connections, and abraded areas.
 - 5. Touch up shop primer and factory-applied finishes.
 - 6. Repair galvanizing with galvanizing repair paint in accordance with ASTM A780/A780M.
- G. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, noncumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING

- A. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.
- B. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.

3.07 PROTECTION

- A. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dimension lumber framing, blocking, nailers, and supports.
- B. Metal plate blocking and steel angle blocking for wall-mounted equipment, grab bars, and specialty items as indicated.
- C. Construction panels and sheathing.
- D. Fireblocking in concealed framed assemblies as required by applicable code.
- E. Preservative-treated wood materials.
- F. Fire-retardant-treated (FRT) wood materials.
- G. Communications and electrical room mounting boards.

1.02 RELATED REQUIREMENTS

- A. Section 092216 - Non-Structural Metal Framing: Light gauge metal studs, track, and furring channels for gypsum board assemblies. Metal furring is excluded from this Section.

1.03 TYPE II-B CONSTRUCTION LIMITATIONS

- A. This project is classified as Type II-B (Non-Combustible, Unprotected) construction per IBC. Wood structural members are not permitted in the primary structural frame. Wood and wood-based products specified herein are limited to non-structural applications only, including blocking, nailers, furring, and miscellaneous carpentry within or applied to non-combustible assemblies, as permitted by the applicable building code and authority having jurisdiction (AHJ).
- B. All wood installed in concealed spaces shall be fire-retardant-treated (FRT) unless otherwise permitted by the AHJ and confirmed in writing. Coordinate with the project Architect before installing any untreated wood in concealed spaces.

1.04 REFERENCE STANDARDS

- A. ALSC - American Lumber Standards Committee, Board of Review.
- B. ASTM A36 - Standard Specification for Carbon Structural Steel.
- C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. AWWPA U1 - Use Category System: User Specification for Treated Wood; current edition.
- F. IBC - International Building Code; edition adopted by AHJ.
- G. PS 1 - Structural Plywood; current edition.
- H. PS 2 - Performance Standard for Wood Structural Panels; current edition.
- I. PS 20 - American Softwood Lumber Standard; current edition.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's data for each type of treated wood product, fastener, and connector used.
- B. Treatment Certificates: For each type of treated wood, submit certification from the treating plant indicating the type and level of treatment, species treated, and compliance with AWWPA standards.
- C. Grading Certificates: For dimension lumber, submit grading certificates from the applicable grading agency confirming species and grade.
- D. FRT Test Reports: For fire-retardant-treated wood used in concealed spaces, submit test reports demonstrating compliance with ASTM E84 and ASTM D2898, and confirming the product does not adversely affect structural integrity at elevated temperatures.

1.06 QUALITY ASSURANCE

- A. Lumber Grading: Provide lumber graded by a grading agency whose rules are approved by the ALSC Board of Review; lumber shall be stamped with the grade mark.
- B. Installer Qualifications: Work shall be performed by a contractor experienced in the installation of rough carpentry in non-combustible construction of similar scope and complexity.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect wood products from moisture during delivery, storage, and installation. Cover stacked materials with waterproof covering; support to prevent deformation and allow air circulation.
- B. Do not deliver treated lumber to the site until the kiln-drying cycle after treatment is complete and moisture content has reached specified levels.
- C. Store FRT lumber and panels in dry, ventilated conditions. Do not wet-cut FRT lumber without reapplying field treatment per manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide materials that are new, free from defects, and of the species, grade, and treatment specified. Do not use materials with wane, shake, or splits exceeding the limits of the specified grade.

2.02 DIMENSION LUMBER

- A. General: Comply with PS 20 and the requirements of the applicable grading agency.
- B. Species and Grade - Framing and Blocking (2 inch to 4 inch thick): Douglas Fir-Larch, No. 2 or better; or Southern Pine, No. 2 or better.
- C. Species and Grade - Nailers and Furring (1 inch nominal): Douglas Fir-Larch or Southern Pine, Standard or No. 3.

- D. Moisture Content: Kiln-dried (KD) or surfaced dry (S-DRY); maximum 19 percent for lumber 2 inch to 4 inch thick; maximum 15 percent for lumber 5 inch and thicker.

2.03 METAL BLOCKING

- A. Where metal blocking is indicated on the drawings or required for support of heavy wall-mounted equipment, grab bars, toilet accessories, or other specialty items, provide the following unless otherwise specified:
 - 1. Steel Plate Blocking: ASTM A36, hot-rolled carbon steel; thickness as indicated on drawings, minimum 3/16 inch where not indicated.
 - 2. Steel Angle Blocking: ASTM A36, hot-rolled; size as indicated on drawings, minimum L2x2x3/16 where not indicated.
 - 3. Finish: Shop prime with rust-inhibiting primer where concealed; hot-dip galvanize or provide stainless steel (Type 304) in wet or high-humidity areas.

2.04 CONSTRUCTION PANELS

- A. Plywood - General: PS 1, grade as specified; span rating and thickness as indicated.
- B. Oriented Strand Board (OSB): PS 2, span rating and thickness as indicated; exterior bond classification.
- C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood or medium density fiberboard (MDF); 3/4 inch thick; flame spread index of 25 or less and smoke developed index of 450 or less when tested per ASTM E84.

2.05 FACTORY WOOD TREATMENT

- A. Fire-Retardant-Treated (FRT) Wood - Type II-B Requirements:
 - 1. All wood installed in concealed spaces shall be fire-retardant treated unless specifically exempted in writing by the Architect and AHJ.
 - 2. Treatment Type: Interior Type A (low hygroscopic); AWPA U1, Use Category UCFA. Do not use exterior-type FRT where interior type is required.
 - 3. Performance: After treatment and re-drying, lumber shall have a flame spread index of 25 or less and smoke developed index of 450 or less per ASTM E84, and shall retain at least 85 percent of design values after accelerated aging per ASTM D2898.
 - 4. Marking: Mark each piece with producer's stamp indicating treatment type, compliance with AWPA standards, and applicable use category.
 - 5. Re-drying: Kiln-dry FRT lumber after treatment to maximum moisture content of 19 percent; FRT plywood to 15 percent.
 - 6. Field Cuts: Treat all field-cut ends and surfaces of FRT lumber with the same manufacturer's listed field-treatment solution prior to installation.
- B. Preservative-Treated Wood:

1. Provide for all wood in contact with concrete, masonry, or exposed to weather; AWP A U1, Use Category UC3B (above-grade exterior) or UC4A (ground contact) as applicable.
2. Marking: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency certifying level and type of treatment.
3. Re-drying: Kiln-dry after treatment; maximum moisture content 19 percent for lumber, 15 percent for plywood.
4. Do not use preservative-treated wood in direct contact with the ground unless rated UC4A or higher.
5. Interior Use: Where preservative-treated wood is used in interior locations, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

2.06 FASTENERS AND CONNECTORS

- A. Nails and Staples: Common wire nails or sinker nails, ASTM F1667; hot-dip galvanized for treated lumber and exterior conditions; bright for interior untreated applications.
- B. Bolts, Nuts, and Washers: ASTM A307 or A325 as required; hot-dip galvanized for treated lumber and exterior conditions.
- C. Joist Hangers, Angles, and Connectors: ICC-ES listed; hot-dip galvanized (ASTM A153) for use with treated lumber. Do not use electroplated connectors with pressure-treated wood.
- D. Screws: ASTM C1002 for wood-to-metal; ASTM F1667 for wood-to-wood; stainless steel or hot-dip galvanized for treated lumber.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which rough carpentry will be installed. Do not begin installation until unsatisfactory conditions have been corrected. Commencement of work within a particular area constitutes acceptance of existing conditions.
- B. Verify that steel framing, embeds, and structural elements to which rough carpentry will be attached are complete, plumb, and at correct elevations before proceeding.

3.02 INSTALLATION - GENERAL

- A. Comply with applicable provisions of IBC and the adopted edition of the National Design Specification (NDS) for Wood Construction for fastening, spacing, and connection design.
- B. Set work plumb, level, and true to line; shim as required. Do not use wood shims in fire-rated assemblies unless shims are also FRT.
- C. Provide double members where shown or required to support loads from structural members, equipment, or concentrated loads above.

- D. Frame openings with multiple members where required by size of opening or loads imposed. Provide headers sized to carry imposed loads; consult Architect for sizes not indicated on drawings.
- E. Coordinate with MEP trades for blocking and nailer locations at equipment, fixtures, and systems requiring wall attachment prior to enclosure of assemblies.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Install blocking, nailers, and grounds where indicated on the drawings and where required for attachment of finish work, casework, equipment, specialties, and other items indicated or reasonably anticipated.
- B. Install blocking in metal stud walls at all locations where wall-mounted items will be attached; size blocking to extend full height between blocking locations or between framing members as required to support the imposed loads.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling unless another method of support is explicitly indicated.
- D. Where metal plate or angle blocking is indicated or required, install blocking plumb and level, secured to structural framing members with welds or bolts as required to develop the full load capacity of the supported item. Coordinate locations with Architect and equipment suppliers prior to installation. Do not use metal blocking as a substitute for FRT wood blocking where FRT wood is specifically required by a fire-rated assembly.

3.04 FIREBLOCKING

- A. Provide fireblocking in all concealed framed assemblies as required by the applicable edition of the IBC and local amendments adopted by the AHJ, to close concealed draft openings between floors, between the top story and the roof or attic space, and at all other locations required by code.
- B. Fireblocking material shall be noncombustible or approved equivalent acceptable to the AHJ. FRT lumber, minimum 2-inch nominal thickness, is acceptable. Other materials (gypsum board, mineral wool, intumescent materials) may be used where listed and approved.
- C. Do not use untreated solid wood as fireblocking in concealed spaces in Type II-B construction without written approval from the Architect and AHJ.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Install panels in accordance with manufacturer's recommendations and as indicated. Stagger joints in adjacent courses.
- B. Provide edge blocking or clips at unsupported panel edges where required by span rating or by the panel manufacturer.
- C. Communications and Electrical Room Mounting Boards: Secure to wall framing with fasteners at 16 inches on center maximum; provide continuous contact with substrate.

3.06 TREATED WOOD - INSTALLATION REQUIREMENTS

- A. FRT Lumber: Handle with gloves and respiratory protection where required by SDS. Keep materials dry during installation. Apply field-cut treatment to all exposed cuts before installing.
- B. Preservative-Treated Lumber: Do not use in direct contact with aluminum. Where in contact with concrete or masonry, verify that treatment type is compatible with concrete additives.
- C. Fasteners: Use only fasteners of the type and material specified for treated wood. Electroplated (EG) fasteners are not acceptable with pressure-treated lumber containing copper-based preservatives.

3.07 TOLERANCES

- A. Framing Members: Plus or minus 3/8 inch from indicated position in plan; plus or minus 1/4 inch from indicated elevation.
- B. Blocking and Nailers: Plus or minus 1/4 inch from indicated position.
- C. Surfaces for Applied Finish Work: Plus or minus 1/8 inch in 8 feet for flatness.

3.08 CLEANING

- A. Remove debris, cut-offs, and scraps from the work area as work progresses. Do not allow accumulation of combustible materials in concealed spaces.
- B. Remove sawdust and wood chips from fireblocking locations before closing assemblies.

END OF SECTION

SECTION 064116 – PLASTIC LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish, deliver, and install all casework as shown on drawings and as specified herein: Plastic Laminate finished fiberboard constructed casework.
- B. Furnish and install all hardware, fillers, scribes, finished ends, finished backs, counter tops, back splashes, and cutouts required to provide a complete and finished project.
- C. Provide locks where shown on casework drawings or described in equipment lists. All sink bases shall have locks.
- D. Inspect and properly adjust all casework and its related hardware. Repair damages, remove and dispose of all packing material, debris, and dirt resulting from casework installation leaving area broom clean.
- E. For plastic laminate finished cabinets, Contractor shall note that millwork shall meet or exceed Premium standards for AWI. Wood grain laminate shall be applied in direction of fine wood furniture. Vinyl edging must match face laminate or edge laminate shall be installed prior to face laminate.
- F. If not noted otherwise, Contractor is to assume wood grain laminate which shall be applied in vertical direction of fine wood furniture.
- G. If not noted otherwise, Contractor is to assume that plastic laminate is to be used for all toe-kicks.

1.02 WORK IN OTHER SECTIONS

- A. All sinks and fittings, couplings and connectors, piping, traps, supplies, shutoffs, and special plumbing fixtures to meet local codes; all electrical fixtures and devices, conduit, wiring, and connectors; and all fans, blowers, motors, ductwork, and metal grilles not specified as part of casework contract including Installation, connection, and testing of all sinks, fittings, electrical fixtures, providing all rough-ins, mechanical piping, electrical runs, and connections required for a complete project. This supplier shall be responsible for coordinating these items to fit into casework where required.
- B. Blocking, framing, and reinforcement in walls, ceilings, and floors for anchoring of cabinets and trim.
- C. General millwork and wood trim items.

- D. Locks master keyed to room doors and other special locks other than cabinet locks specified herein.

1.03 QUALIFICATIONS

- A. The casework shall conform to configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings.
- B. Manufacturers requesting approval shall submit samples with cutaways showing cabinet construction if requested, joinery, drawer and door construction, hardware, and materials; along with catalogs and specification in order that accurate evaluations can be made. Samples may be impounded for the duration of contract to ensure construction specification compliance.
- C. Work in this section shall comply with the specified grade(s) of work and section (s) of the current edition of the Architectural Woodwork Institute Quality Standards.

1.04 SUBMITTALS

- A. Shop drawings shall be submitted for approval according to Section 013000. Drawings shall consist of all elevations, sections and plans as necessary to indicate arrangement and relation to adjacent work and equipment. Centerline of service requirements shall be noted for use by other trades.
- B. Color samples shall be submitted for selection and coordination at time of contract award. Samples of actual material and colors shall be available as required.

1.05 COLOR SELECTION

- A. Colors and patterns as indicated on drawings.
- B. All exposed exterior cabinet body edges and door and drawer edges shall be color matched with cabinet sides, doors, and drawer fronts.

PART 2 - PRODUCTS

2.01 CABINET MATERIALS

- A. Cabinets shall be constructed 45pcf minimum density (medium) fiberboard except that all countertops and shelves at sink bases shall be 3/4" plywood with exterior rated glue. PARTICLE BOARD IS NOT ACCEPTABLE. See component description for thickness.
- B. Doors shall be laminated both sides with 1/32 inch high pressure plastic laminate.
- C. All exposed exterior surfaces should be laminate with 1/32 inch plastic laminate.
- D. All exposed edges of cabinets, doors and drawer edges shall be 3mm minimum vinyl in colors as selected by Architect.

- E. All countertop (counter) edges shall be 3mm "T-Molding" equal to #3333 by Charter Industries (unless indicated otherwise on Drawings) with a minimum of 16 stock colors. Color to be selected by Architect.
- F. All framing members should be laminate on both sides and exposed edges.
- G. All exposed interior surfaces should be laminated with .025 inch, high pressure plastic laminate cabinet liner including shelves and dividers or shall be constructed of thermally fused Melamine surfaced material meeting NEMA LD3-1991-GP28 and American Laminators Assoc. Standards 1988.
- H. Drawers: Drawer fronts should have 1/32 inch plastic laminate on exposed face of fiberboard board core with .025 inch plastic laminate liner on interior surface. Drawer front edges should be edged with vinyl to match face laminate. Drawer body should be laminated on both sides with .025 inch plastic laminate liner (see G) with top edges receiving edge trim. Drawer bottoms should be laminated with .025 inch plastic laminate liner (see G).

2.02 HARDWARE

- A. Hinges: shall be Blum Module 170 degree concealed, European style, 170 degree opening (90 degree opening where adjacent to wall), self-closing. Products by Hafele are approved for bidding.
- B. Pulls shall be cast brass, accurately positioned on door and drawer front with machine screws. Pulls shall be Stanley #4484. Finish shall be brushed aluminum. Equal pulls by Hafele are approved for bidding.
- C. Drawers and glide out shelves shall be suspended on nylon roller steel slides to insure quiet, smooth operation. Slides shall have 100 pound load rating (minimum) with built in drawer stop and self close feature in the last one inch of travel. Glides shall be full extension K & V 8400 typical or Hafele Accuride.
- D. File drawers shall be suspended on full extension steel slides with ball bearings and a 100 pound minimum load rating, equal to K&V 8400 or Hafele Accuride. In addition file drawers shall be provided with hanging frames. Hanging file rail shall be mounted on drawer sides manufactured by CPF. An equivalent framing system by KineFlex is acceptable. Submit shop Drawing for approval indicating details, manufacturer, etc.
- E. Locks will be provided where shown on drawings or cabinet description: Locks shall be cylinder type, die cast, with five disc tumbler mechanism. Each lock shall be provided with 3 milled brass keys. Provide option of selecting keyed alike, keyed different, and master keyed locks; Knappe Vogt 986, Corbin 02067, Yale 9730 - see plan notes for more specifics.

- F. Adjustable shelf standards and supports shall be Stanley 798/799, Knappe & Vogt 255 or Grant 120/121. Line Boring with metal support clips is acceptable.
- G. Grommets shall be 1 3/4" satin chrome (equal to Mockeet).
- H. K&V or Hafele Glass Window Tracks where noted. Refer also to Section 11132 for Television and Monitor Equipment. This contractor shall coordinate installation of these devices into the millwork. Confirm supplier with general contractor.
- I. Counter supports shall be equal to Rakks EH Series for Concealed Mounted Installation as manufactured by Rangine Corporation, Needham, Massachusetts 02494, Phone (781) 455-8700.

2.03 WORK SURFACES & DECORATIVE SURFACES

- A. Plastic laminate counter tops shall be surfaced with general purpose .050 thick plastic laminate meeting NEM spec. LD3-1975 GP-50. Counter top cores shall be 3/4" exterior grade AB plywood. All exposed edges which are not solid surface or engineered quartz shall be as specified above.
- B. Back splashes and end splashes are to be provided as indicated on drawings and shall be surfaced with same laminate as top with coved transition unless noted otherwise. Unless noted otherwise back splashes shall be full height to bottom of cabinet. Where 4" or 6" back splash are shown core shall be 3/4" exterior plywood (edging to be 1mm). All counters with sinks shall have back splashes. Provide backer for cove from top to splash.
- C. Refer to Section 123600 Countertops for Solid Surface counters.

2.04 COMPONENT DETAILS

- A. Corner joints incorporated in cabinets shall be equal to dowel pin construction and must be factory glued and clamped under pressure to assure rigid load bearing corner joints.
- B. Cabinet ends shall be 3/4-inch-thick panels of balanced construction; precision bored for dowel pins installed in horizontal cabinet members. Base and tall units shall have one piece end panels continuous to floor for added load capabilities. Unexposed ends shall have laminate backing sheet.
- C. Cabinet bottoms and tops shall be 3/4-inch-thick panels of balanced construction for base and tall units.
- D. Kick panels shall be four inch high, set back from the cabinets front edge and mechanically fastened to the cabinet bottom and ends, becoming an integral part of the cabinet structure.
- E. Back panels shall be set 3/8-inch-thick set in cabinet side grooves with melamine finish. Wall cabinet backs shall also set in top and bottom shelf grooves.

- F. Finished exposed backs of fixed cabinets are to be 3/4-inch-thick panels of balanced construction surfaces.
- G. Frame rails between drawers must be full length, 3/4-inch-thick x 3-1/2 inch wide, dowel pinned, and fastened into cabinet sides.
- H. Hang rails shall be provided in wall cabinets in the upper back corner for mounting units to wall.
- I. Drawers shall be full box design with a separate front. Drawer sides and end must be constructed of 5/8-inch-high density fiberboard. Bottoms shall be 1/4-inch thickness. Corner joints shall be interlocking dowel pin design. Hardwood dowel pins eight mm diameter shall be inserted into drawer ends and fitted into matching hole patterns in drawer sides. Bottoms must be trapped in grooves all four sides. All joints shall be glued and bottoms shall have additional mechanical fasteners. Drawers shall be suspended on slides. Seal drawer joints to match finish & make them leakproof.
- J. Solid hinged doors shall be 3/4-inch-thick material of balanced construction. Doors 48 inches and less in height shall have two hinges per door. Doors above 48 inches in height, but not exceeding 63 inches in height, shall have three hinges per door, and all doors in excess of 63 inches in height shall have four hinges per door. Doors over 48" shall be 1" thick. Adjacent doors shall match in thickness.
- K. Adjustable shelves less than 36 inches in length shall be 3/4 inches thick. Shelves 36 inches long and over, and all adjustable shelves in wall cabinets and bookcases, shall be one inch thick. All adjustable shelves shall be constructed of 50-pound density fiber board.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Verify adequacy of backing and support framing before proceeding.
- B. Set and secure casework in place rigid, plumb, and level. Permanently fix cabinet and counter bases to floor using appropriate angles and anchorages.
- C. Use purpose designed fixture attachments at concealed locations for wall mounted components.
- D. Carefully scribe casework which is against other building materials, leaving gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinet and counter bases to walls using appropriate angles and anchorages.
- F. Counter sink anchorage devices at exposed locations used to wall mount components, and conceal with solid plugs of species to match surrounding wood. Finish flush with surrounding surfaces.

- G. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units, counter tops and overhead cabinets.

3.02 ADJUSTING AND CLEANING

- A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at exterior wall behind exterior wall finish
- B. Batt insulation in exterior wall construction
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof construction

1.02 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- H. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.
- I. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2021a.
- J. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.
- K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.04 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 Over Metal Stud Framed Walls, Continuous: Polyisocyanurate board.
- B. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Rigid Cellular Polyisocyanurate (ISO) Thermal Insulation Board with Facers Both Sides: Complying with ASTM C1289.
 - 1. Classifications:
 - a. Type I: Faced with aluminum foil on both major surfaces of core foam.
 - 1) Class 1 - Non-reinforced core foam.
 - 2) Compressive Strength: 16 psi, minimum.
 - 3) Thermal Resistance, R-value: At 1 inch thick; 5.0, minimum, at 75 degrees F.
 - 2. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Comply with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - 5. Board Size: 48 inch by 96 inch.
 - 6. Board Edges: Square.
 - 7. Products:
 - a. GAF
 - b. Sika
 - c. Johns Manville
 - d. DuPont de Nemours, Inc
 - e. Substitutions: See Section 016000 - Product Requirements.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 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.
 - 4. Thermal Resistance:
 - a. R-13 min at walls

- b. R-38 min at attics

- 5. Facing: Aluminum foil, flame spread 25 rated; one side.

2.04 ACCESSORIES

- A. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- B. Insulation Fasteners: Appropriate for purpose intended.
- C. Support for Continuous Rigid Insulation:
 - 1. Fastening Clips: Two-piece PVC insulation clips with retainer and T-shaped clips mechanically fastened to surface receiving insulation, depth to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

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.
- B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.
- B. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and protrusions.
- C. Extend boards over expansion joints, unbonded to wall on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.03 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof 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. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Staple or nail facing flanges in place at maximum 6 inches on center.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 072432 – DIRECT APPLIED STUCCO FINISH SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A This section includes materials and installation of exterior direct-applied ci rigid insulation with cement board stucco backed with a drainage mat and an air and water-resistive barrier applied to sheathing on steel frame walls.

1.02 RELATED SECTIONS

- A Section 076200 - Sheet Metal Flashing and Trim
- B Section 079200 - Joint Sealants

1.03 REFERENCED DOCUMENTS

- A ASTM International (ASTM)
 - 1. C150 - Specification for Portland Cement
 - 2. C297 - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
 - 3. C578 - Specification for Preformed, Cellular Polystyrene Thermal Insulation
 - 4. C920 - Specification for Elastomeric Joint Sealants
 - 5. C1177 - Specification for Glass Mat Gypsum for Use as Sheathing
 - 6. C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets
 - 7. D4541 - Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 - 8. E84 - Test Method for Surface Burning Characteristics of Building Materials
 - 9. E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 10. E283 - Test Methods for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 11. E330 - Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - 12. E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
 - 13. E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
 - 14. E2178 - Standard Test Method for Determining Air Leakage of Air and Water-Resistive Barrier Assemblies
 - 15. E2430 - Standard Specification for Expanded Polystyrene ("EPS") Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems (EIFS)
- B APA Engineered Wood Association
 - 1. PS1 - Voluntary Product Standard, Structural Plywood
 - 2. PS2 - Performance Standard for Wood-Based Structural-Use Panels
 - 3. E30 - APA Engineered Wood Construction Guide
- C ICC ES (International Code Council)

1. 2021 IBC (International Building Code) and IRC (International Residential Code)
- D ICC ES (International Code Council Evaluation Service)
 1. AC59 - Acceptance Criteria for Direct Applied Exterior Finish Systems (DEFS)
 2. ICC ESR 1233 - StoGuard Air Barrier and Water-Resistive Barrier System and StoEnergy Guard (StoGuard with Continuous Insulation)
 3. ICC ESR 2536 - StoQuik Silver I, StoQuik Silver II, and StoQuik Silver NExT Cement Board Stucco Systems
- E National Fire Protection Association (NFPA) Standards
 1. NFPA 285 - Standard Methods of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus
 2. NFPA 268 - Standard Test Method of Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
- F Sto Technical Publications
 1. Detail Series 11.xx, StoQuik Silver DrainScreen Detail Booklet
 2. Sto RapidGuard Installation Guide
 3. StoGuard Comfortable Membrane Installation Guide
 4. Detail Series 24.xx, StoShield SA Self-Adhered Membrane Air & Water -Resistive Barriers Installation Guide
 5. Sto Tech Hotline 0370-S Accessories for StoQuik Silver Cement Board Stucco Systems
 6. Sto Tech Hotline 0407-S, Keys to Success: StoQuik Silver Cement Board Stucco Systems
- G Underwriters Laboratories
 1. UL ER22158-01 - PermaBase Cementitious Backer Units
- H USEPA (United States Environmental Protection Agency)
 1. 40 CFR Part 59 - Code of Federal Regulations Title 40 Part 59 – National Volatile Organic Compound Emission Standards for Consumer and Commercial Product

1.04 DESIGN REQUIREMENTS

- A Structural (wind and axial loads)
 1. Design for maximum allowable deflection, normal to the plane of the wall of L/360
 2. Design for wind load in conformance with code requirements using framing members designed to comply with the standards, strength, and stiffness requirements of the applicable code.
 3. Minimum Stud Size/ Gauge: wood studs, minimum 2x4; metal studs, minimum 18 gauge, 3-5/8 inch deep
 4. Maximum stud spacing: 16 inches (406mm) on center

5. Sheathing: minimum 1/2 inch (13mm) glass mat faced gypsum sheathing in compliance with ASTM C 1177 or minimum 7/16 inch (11 mm) Exterior or Exposure I plywood or OSB wood-based sheathing in compliance with US DOC PS-2
6. Drainage mat: maximum 1/4 or 3/8 inch (6 or 10mm) thick tangled filament core with fabric facing.
7. Screw fasteners for cement board:
 - a. Steel framing – minimum #8 Type S-12 corrosion resistant screws with minimum 0.395 inch (10mm) wafer head diameter and minimum 3/8 inch (9.5mm) and three thread penetration into framing
8. Cement board fastener spacing: maximum 8 inches (203mm) vertically along studs
9. Ultimate wind load resistance capabilities:
 - a. Metal framing capable of achieving +159 psf, -81 psf (+7.61kPa, -3.88kPa): minimum 18 gage (0.045 mil) or heavier, minimum 3-5/8 inch (92mm) depth and 1-5/8 inch (41.3mm) flange width, cold formed C-shaped steel stud framing spaced 16 inches (406mm) on center maximum.
 - b. Metal framing capable of achieving +166 psf, -94 psf (+7.94kPa, -4.50kPa): minimum 16 gage or heavier, minimum 6 inch (152mm) depth and 2 inch (50.8mm) flange width, cold formed C-shaped steel stud framing spaced 16 inches (406mm) on center maximum.

B Moisture Control

1. Prevent the accumulation of water into or behind the cement board stucco, either by condensation or leakage into the wall construction, in the design and detailing of the wall assembly:
 - a. Provide corrosion resistant flashing to protect exposed elements and to direct water to the exterior, including, above window and door heads, beneath window and door sills, at floor lines, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, and at the base of the wall.
 - b. Air Leakage Prevention – prevent excess air leakage in the design and detailing of the wall assembly. Provide continuity between air and water-resistive barrier components in the wall assembly.
 - c. Vapor Diffusion and Condensation – perform a dew point analysis of the wall assembly to determine the potential for accumulation of moisture in the wall assembly as a result of water vapor diffusion and condensation. Adjust wall assembly components accordingly to minimize the risk of condensation. Avoid the use of vapor retarders on the interior side of the wall in warm, humid climates.

- d. Provide StoGuard Air and Water-Resistive Barrier and Sto DrainScreen over sheathing.
- e. At through wall expansion joints and at joints formed with back-to-back casing beads, back joints with StoGuard Conformable Membrane. Refer to Sto Guide Details at www.stocorp.com.
- f. Seal cement board stucco accessory butt joints with appropriate sealant. Seal all cement board stucco terminations and penetrations through the cement board stucco wall assembly with appropriate sealant, or backer rod and sealant, as dictated by joint type.

C Grade Condition

- 1. Do not specify cement board stucco for use below grade or on surfaces subject to continuous or intermittent water immersion or hydrostatic pressure. Provide minimum 6 inch (150mm) clearance above grade. Provide increased clearance in freeze/thaw climate zones.

D Sloped Surfaces, Including Foam Trim and projecting Architectural Features Attached to Cement Board

- 1. Avoid the use of cement board stucco on build-outs or weather exposed sloped and horizontal surfaces (refer to 2 and 3 below).
- 2. Build out trim and projecting architectural features from the cement board wall surface with code compliant EPS foam. All foam trim and projecting architectural features must have a minimum 1:2 [27°] slope along their top surface. All foam horizontal reveals must have a minimum 1:2 [27°] slope along their bottom surface. Increase slope for northern climates to prevent accumulation of ice/snow and water on surface. Where trim/feature or bottom surface of reveal projects more than 2 inches (51mm) from the face of the wall plane, protect the top surface with waterproof base coat. Limit foam thickness to a maximum of 4 inches (102mm). Periodic inspections and increased maintenance may be required to maintain surface integrity of finishes on weather exposed sloped surfaces. Limit projecting features to easily accessible areas and limit total area to facilitate maintenance and minimize maintenance burden.
- 3. Do not use foam on weather exposed projecting ledges, sills, or other projecting features unless supported by framing or other structural support and protected with metal coping or flashing.

E Joints and Accessories

- 1. Provide back-to-back casing beads in the cement board stucco assembly where building movement is anticipated: at joints in the substrate or supporting construction, where the system is to be installed over dissimilar construction or substrates, at changes in building

height, at floor lines, at columns and cantilevered areas. Back the joint with StoGuard Conformable Membrane.

2. Provide one piece control joints at no greater than 25 ft (7.6m) intervals and 625 ft² (58m²) for light colors (LRV > 70), and at no greater than 16 ft (4.68m) and every 256 ft² (23.5m²) for dark colors (LRV < 70 and > 30). Do not exceed length to width ratio of 2-1/2:1 in expansion joint layout.
3. Provide one piece control joints at through wall penetrations, for example, at corners above and below windows, above doors, and similar penetrations through the wall. Alternatively use minimum 9 inch (229 mm) wide diagonal mesh reinforcement at corners over cement board sheathing that is cut in an "L" shape around the corner of the opening.
4. Provide minimum 3/8 inch (9 mm) wide joints where the system abuts windows, doors and other through wall penetrations.
5. Provide appropriate accessories at cement board stucco terminations and joints.
6. Avoid the use of channel reveal accessories which can interfere with proper drainage and proper stress relief.
7. Provide appropriate sealant at cement board stucco terminations and at stucco accessory butt joints.
8. Indicate location of joints, accessories and accessory type on architectural drawings.

F Fire Protection

1. Noncombustible Construction: limited to use on building less than or equal to 40-ft (12.2m) in height. Provide full width firestops at floor lines, typically 4 pcf (64kg/m³) semi-rigid mineral wool, where metal framing runs continuously past floor line. Refer to Sto Details.
2. Provide 15-minute thermal barrier, typically minimum 1/2 inch thick interior gypsum wall board or exterior gypsum sheathing, to separate combustible components on the exterior from interior space.
3. Fire-Resistance Rated Construction: where an hourly fire-resistance rating is required consult ICC ESR 2536 and UL ER22158-01 and provide analysis where needed of the final proposed wall assembly to verify rating is met.

G Color Limitations

1. Select Colors with a lightness reflectance value (LRV) of ≥ 30 and as dictated by allowable joint spacing (1.04 E2). Refer to Sto Color Chart for LRVs.

1.05 PERFORMANCE REQUIREMENTS

A Air and Water-Resistive Barrier

1. Compliant with ICC-ES Acceptance Criteria AC212
2. Material Air Leakage Resistance, ASTM E2178: less than 0.02 L/s·m² (0.004 cfm/ft² at 1.57 psf)

3. Assembly Air Leakage Resistance, ASTM E2357: less than $0.2 \text{ L/s}\cdot\text{m}^2$ (0.04 cfm/ft^2 at 1.57 psf)
 4. Water Vapor Permeance, Vapor Permeable, ASTM E96, Method B: greater than 10 perms [$573 \text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$]. Vapor Impermeable, ASTM E96, Method A less than 0.1 perms [$5.73 \text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$].
 5. Surface Burning, ASTM E84: Flame Spread less than 25, Smoke Developed less than 75, Class A Building Material
 6. Tensile Adhesion, ASTM C297: $> 15 \text{ psi}$ (103 kPa)
 7. VOC, calculation:
 - a. Less than 50 g/L
 - b. Compliant with US EPA 40 CFR 59 for Architectural Coating, Waterproofing/Sealer
 - c. Compliant with South Coast AQMD Rule 1113 for Building Envelope Coating
- B Drainage Mat
1. Surface Burning, ASTM E 84: Flame Spread less than 25, Smoke Developed less than 450, Class A Building Material
- C Direct-Applied Cement Board Stucco Finish System and Components
1. Compliant with ICC-ES AC59.
 2. Surface Burning, ASTM E84: Flame Spread less than 25, Smoke Developed less than 450, Class A building material
 3. VOC: less than 50 g/L , compliant with South Coast AQMD Rule 1113 for Architectural Coatings

1.06 SUBMITTALS

- A Manufacturer's specifications, details, installation instructions and product data
- B Manufacturer's code compliance report for air and water-resistive barrier
- C Manufacturer's code compliance report for cement board stucco
- D Manufacturer's standard warranty
- E Samples for approval as directed by architect or owner
- F Fastener manufacturer's pull-out or withdrawal capacity testing for frame construction
- G Prepare and submit project specific details (when required by contract documents)

1.07 QUALITY ASSURANCE

- A Manufacturer Requirements
 1. Cement board stucco and air and water-resistive barrier products manufacturer for a minimum of twenty-five (25) years.
 2. Cement board stucco finish products and air and water-resistive barrier products manufactured under ISO 9001 Quality System and 14001 Environmental Management System.

B Contractor Requirements

1. Licensed, insured and engaged in application of stucco for a minimum of three (3) years.
2. Knowledgeable in the proper use and handling of Sto materials.
3. Employ skilled mechanics who are experienced and knowledgeable in stucco application, and familiar with the requirements of the specified work.
4. Successful completion of minimum of three (3) projects of similar size and complexity to the specified project.
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with Sto's published specifications and details and the project plans and specifications.

C Foam and Trim Insulation Board Manufacturer Requirements

1. Manufacturer of ASTM C578 compliant insulation board, listed by an approved agency. Label insulation board with information required by Sto, the approved listing agency, and the applicable building code
2. Insulation board listed in a current ICC-ES evaluation report

D Cement Board Manufacturer Requirements

1. Manufacturer of ASTM C1325 compliant cement board
2. Cement board listed in a current UL evaluation report

E Testing

1. Construct full-scale mock-up of typical cement board stucco/window wall assembly with specified tools and materials and test air and water infiltration and structural performance in accordance with ASTM E283, E331 and E330, respectively, through independent laboratory. Mock-up shall comply with requirements of project specifications. Where mock-up is tested at job site maintain approved mock-up at site as reference standard. If tested off-site accurately record construction detailing and sequencing of approved mock-up for replication during construction.
2. Conduct air and water-resistive barrier adhesion testing in accordance with ASTM D4541.
3. Conduct air and water-resistive barrier assembly testing in accordance with ASTM E779.
4. Verify adequacy of pull-out or withdrawal capacity of fasteners used for frame construction with manufacturer in relation to negative design wind pressures.
5. Conduct wet sealant adhesion testing in accordance with sealant manufacturer's field quality control test procedure.
6. Notify design professional minimum 7 days prior to testing.

F Inspections

1. Provide independent third party inspection where required by code or contract documents.
2. Conduct inspections in accordance with code requirements and contract documents.

1.08 DELIVERY, STORAGE, AND HANDLING

- A Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.
- B Protect foam plastic insulation materials from prolonged UV exposure, keep away from sources of heat, sparks, flame, flammable or volatile materials. Store on a clean, flat surface, off the ground in a dry area.
- C Store cement board materials inside and protect from damage by the elements. Protect ends, edges, and faces of cement boards from damage.
- D Protect coatings (pail products) from freezing and temperatures in excess of 90°F (32°C). Store away from direct sunlight.
- E Protect portland cement-based materials (bag products) from moisture and humidity. Store under cover off the ground in a cool, dry location.
- F Protect STPE gun grade air barrier detailing products and sealant products from freezing and temperatures in excess of 90°F (32°C). Store in a cool, dry location away from direct sunlight and from sources of ignition.
- G Handle and store all products as directed on labeling.

1.09 PROJECT/ SITE CONDITIONS

- A Maintain ambient and surface temperatures above 40°F (4°C) during application and for 24 hours after application of air and water-resistive barrier and cement board stucco finish materials.
- B Provide supplementary heat for installation in temperatures less than 40°F (4°C) such that material temperatures are maintained as in 1.9A. Prevent concentration of heat on wet cement board stucco finish materials and vent fumes and other products of combustion to the outside to prevent contact with materials.
- C Prevent uneven or excessive evaporation of moisture from base coat during hot, dry or windy weather. Do not install base coat or finish coat if ambient temperatures are expected to rise above 100°F (38°C) within a 24-hour period.
- D Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.10 COORDINATION/ SCHEDULING

- A Protect sheathing from climatic conditions to prevent weather damage.
- B Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air and water-resistive barrier and continuous moisture protection. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall and provide sill flashing. Coordinate installation of air and water-resistive barrier components with window and door installation to provide weather proofing of the structure and to prevent moisture infiltration and excess air infiltration.

- C Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.
- D Install window and door head flashing immediately after windows and doors are installed.
- E Splice-in head flashing, floor line flashing, diverter flashing, and similar flashing with air and water-resistive barrier detail component to provide a shingle lap that directs water to the exterior.
- F Protect the air and water-resistive barrier within the period allowed by the manufacturer. Refer to manufacturer's published information.
- G Protect drainage mat with cement board or other protection within 30 days of installation.
- H Commence the cement board stucco installation after completion of all floor, roof construction and other construction that imposes dead loads on the walls to prevent excessive deflection (and potential cracking) of the cement board stucco.
- I Sequence interior work such as drywall installation prior to cement board stucco installation to prevent stud distortion (and potential cracking) of the cement board stucco.
- J Provide site grading such that the stucco terminates above earth grade minimum 6 inches (152 mm). Provide increased clearance in freeze/thaw climate zones.
- K Install copings and sealant immediately after installation of the cement board stucco finishes and when finish coatings are dry.
- L Attach penetrations through cement board stucco to structural support and provide airtight and water tight seals at penetrations.

1.11 WARRANTY

- A Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A Air and Water-Resistive Barrier, Drainage Mat, Cement Board Stucco Base Coat, Primers, Finishes, Joint Sealant Accessory, Outside Corner Bead and Drip Edge Accessories
 - 1. Sto Corp., 3800 Camp Creek Parkway, Building 1400, Suite 120. Atlanta, GA 30331
- B Cement Board
 - 1. National Gypsum Company, Inc., 2001 Rexford Road, Charlotte, NC 28211
- C Cement Board Stucco Accessories
 - 1. Plastic Components, Inc., 9051 NW 97th Terrace, Miami, Florida 33178

2.02 AIR AND WATER-RESISTIVE BARRIER

- A StoGuard Detail Components
 - 1. Sheathing Joint Treatment, Rough Opening (RO) Protection, Counterflashing, and Penetrations

- a. Sto Gold Coat: brush spray or roller applied air and water-resistive barrier coating used with StoGuard Fabric reinforcement
 - b. Sto RapidGuard: single component rapid drying gun-applied STPE detail component
 - c. Sto Gold Fill: trowel applied detail component used with StoGuard Mesh, glass fiber self-stick reinforcing mech
 - d. StoGuard Conformable Membrane – self adhered membrane flashing for use over prepared vertical above-grade concrete, concrete masonry, brick masonry, glass mat gypsum sheathing
2. Static Joints and Seams
- a. Sto RapidGuard: single component rapid drying gun-applied treatment for static joint transitions to dissimilar construction (i.e., masonry to frame wall), balcony floor slab to ceiling, and wall sheathing to foundation
3. Static and Dynamic Joints
- a. StoGuard Comformable Membrane: self-adhered membrane flashing for use over prepared vertical above-grade concrete, concrete masonry, brick masonry, wood sheathing, glas mat gypsum sheathing, and cementitious sheathing used to:
 - 1) Seal joints and seams in wall sheathing
 - 2) Seal static joints between dissimilar materials
 - 3) Flash exterior wall openings and protect rough openings
 - 4) Seal between window flange and wall sheathing
 - 5) Connect to above grade foundation waterproofing
 - 6) Connect to roof membrane
 - 7) Seal around wall penetrations such as pipes, scuppers, vents
 - 8) Back masonry wall ties
 - 9) Seal dynamic joints in wall construction
- B Air and Water-resistive Barrier Coating
- 1. Sto Gold Coat: ready mixed vapor permeable air and water-resistive barrier coating applied
 - a. By substrate as follows:
 - 1) Glass Mat Gypsum: apply one coat at minimum 10 mils WFT
 - 2) Plywood: apply one coat at minimum 10 mils WFT
 - 3) Cement Board: apply one coat at minimum 10 mils WFT
 - 4) OSB: apply one or two coats at minimum 20 mils WFT. If applied by roller, apply two coats. Touch up any bare spots and raised OSB strands
 - 5) CMU: apply two or three coats at minimum 20-60 mils WFT.
 - 6) Concrete: apply one coat at minimum 10 mils WFT

- b. To a Medium-Build in one or two coats to achieve minimum 20 mils WFT (if applied by roller apply two coats to achieve minimum 10 mils WFT. For CMU substrates apply two or three coats to achieve 10-60 mils WFT).
- c. To a High-Build in two or three coats to achieve 40 mils WFT (if applied by roller apply three or more coats as needed. For CMU substrates apply multiple coats to achieve 40-60 mils WFT)

2.03 ACCESSORIES FOR CEMENT BOARD STUCCO

- A Starter Track – Starter Track Drip Edge (Product No. STDE-xx) or i Drip Track (Product No. iDT-xx), rigid PVC (polyvinyl chloride) plastic tracks with weepholes as furnished by Plastic Components, Inc., for use at terminations such as base of wall, floor lines, roof lines, and similar weep termination lines.
- B Casing Bead – Starter Trac (Product No. ST-xx), a rigid PVC (polyvinyl chloride) plastic accessory as furnished by Plastic Components, Inc., for use at terminations such as windows, doors, and similar through wall penetrations, and used back-to-back at movement joints such as dissimilar materials, through wall expansion joints, and floor line deflection joints. May also be used back-to-back in lieu of a single piece control joint.
- C Outside Corners – Sto-Mesh Corner Bead Standard, one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh for outside corner reinforcement.
- D Drip Edge - Sto Drip Edge Profile, one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh that creates a drip edge and plaster return.
- E Control Joint – “V” Control Joint (Product No. PL 093), rigid PVC (polyvinyl chloride) plastic single piece control joint as furnished by Plastic Components, Inc., for use at intervals in the field of the wall, and at corners of penetrations such as windows, doors, and similar through wall penetrations.
- F Joint Sealant - StoSeal® STPE low modulus joint sealant in conformance with ASTM D920: Type S, Grade NS, Use NT, A, M, Class 100/50

2.04 DRAINAGE MAT

- A Sto DrainScreen 10mm – nominal 3/8 inch (10mm) tangled filament core drainage mat with fabric facing.

2.05 INSULATED CEMENT BOARD SHEATHING, WALL AND SOFFIT: ASTM C1289, TYPE I OR TYPE II, CLASS 2, RIGID, CELLULAR, POLYISOCYANURATE THERMAL INSULATION BONDED TO 1/4 INCH CEMENT BOARD.

- A Basis of Design: PermaBASE Building Products, LLC provided by National Gypsum Company:
 - 1. PermaBASER **ci^T** Insulated Cement Board
 - 2. Thickness: 1 1/4 inch minimum

3. R-Value: ASTM C518 6 minimum.
4. Edges: Square.

2.06 FASTENERS FOR INSULATED CEMENT BOARD SHEATHING:

- A Fasteners for 1 1/4 inch thick panels at metal framing:
1. Triangle Fasteners, Concealor Pancake Head Self-Drilling Screw, uam.trianglefastener.com.
 2. TRUFAST, TRUFAST SIP & Nail Base Fastener, uzwv.trufast.com.
 3. OMG/FastenMaster, Fasteirnaster HeadLOK Fastener, uam.fasteninaster.com.

2.07 FOAM INSULATION BOARD FOR TRIM

- A Sto EPS Insulation Board--nominal 1.0 lb/ft³ (16 kg/m³) Expanded Polystyrene (EPS) Insulation Board in compliance with ASTM C578 Type I requirements, and ASTM E2430

2.08 JOB MIXED INGREDIENTS

- A Water: clean and potable.
- B Portland cement: Type 1 in compliance with ASTM C150

2.09 CEMENT BOARD STUCCO JOINT REINFORCEMENT

- A StoGuard Mesh with Sto base coat

2.10 CEMENT BOARD STUCCO AND FOAM TRIM BASE COAT

- A Base Coat
1. Sto Primer/Adhesive-B – one component polymer modified portland cement base coat material
 2. Sto BTS Plus – one component polymer modified portland cement high build base coat material
 3. Sto BTS Xtra – one component polymer modified portland cement extra high build base coat material
 4. Sto Flexyl – two component fiber reinforced acrylic based waterproof base coat material field mixed with portland cement (for use as a waterproof base coat to waterproof foundations, parapets, splash areas, trim and other projecting architectural features).

2.11 CEMENT BOARD STUCCO AND FOAM TRIM REINFORCING MESH

- A Sto Mesh--nominal 4.5 oz./yd² (153g/m²), symmetrical, interlaced open-weave glass fiber mesh treated with alkaline resistant coating for compatibility with Sto materials (achieves Standard Impact Classification over foam insulation board).
- B Sto Detail Mesh--nominal 4.2 oz./yd² (143g/m²), flexible, symmetrical, interlaced open-weave glass fiber fabric treated with alkaline resistant coating for compatibility with Sto materials (used for standard foam backwrapping and aesthetic detailing).

2.12 PRIMER

- A StoPrime Sand – acrylic based tinted, sanded primer for base coat surfaces.

2.13 FINISH

- A StoPowerwall Finish – integrally colored, factory blended, flexible acrylic textured wall finish with graded marble aggregate.

2.14 MIXING

- A StoGuard
 - 1. Sto Gold Fill – mix with a clean, rust-free electric drill and paddle to a uniform consistency. Do not thin, or dilute with water.
 - 2. Sto Gold Coat – mix with a clean, rust-free electric drill and paddle to a uniform consistency. Do not thin, or dilute with water.
- B Adhesive and Base Coats for Cement Board Stucco and Foam Build-outs:
 - 1. Refer to applicable Sto Products Bulletin for selected adhesive/ base coat material(s).
- C Primer – mix with a clean, rust-free high speed mixer to a uniform consistency.
- D Finish – mix with a clean, rust-free high speed mixer to a uniform consistency. A small amount of water (up to 12 ounces [0.4L]) may be added to adjust workability. Limit addition of water to amount needed to achieve the finish texture.
- E Mix only as much as can readily be used. Do not add lime, anti-freeze compounds, or other additives to any of the materials.

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A Pre—qualify under Quality Assurance requirements of this specification (section 1.07.B).

3.02 EXAMINATION

- A Inspect sheathing surfaces for:
 - 1. Damage and deterioration.
 - 2. Moisture damage – record any areas of moisture damage.
- B Inspect sheathing application for compliance with applicable requirement:
 - 1. Glass Mat Faced Gypsum Sheathing in compliance with ASTM C 1177 – refer to manufacturer's instructions and/or ICC evaluation report
 - 2. Exterior Grade and Exposure 1 wood-based sheathing – APA Engineered Wood Association E 30.
- C Report deviations from the requirements of project specifications or other conditions that might adversely affect the air and water—resistive barrier, or cement board stucco installation to the General Contractor. Do not proceed with air and water—resistive barrier, or cement board stucco installation until deviations are corrected.

3.03 SURFACE PREPARATION

- A Sheathing
 - 1. Remove surface contaminants and replace damaged sheathing.

2. All sheathing must be handled and installed in compliance with applicable building code and/or manufacturer requirements. Installed sheathing must be clean, dry and free from damage, frost, and all bond—inhibiting materials. Abut gypsum sheathing joints. Gap wood sheathing 1/8 inch (3 mm) at joints. Should gaps exceed 1/8 inch (3 mm) up to 1/2 inch (13 mm) wide, use Sto RapidGuard to fill joints, or apply low expanding urethane foam into joints and rasp or shave flush with sheathing surface in preparation for installation of StoGuard joint treatment.
3. Spot surface defects in sheathing with joint treatment (Sto Gold Fill, Sto RapidGuard, or Sto Gold Coat).

3.04 AIR AND WATER-RESISTIVE BARRIER INSTALLATION

- A The following instructions are applicable to:
 1. Exterior or Exposure I Plywood in compliance with PS—1
 2. OSB (Oriented Strand Board) in compliance with PS—1 or PS—2
 3. Glass Mat Faced Gypsum Sheathing in compliance with ASTM C 1177
- B Transition Detailing
 1. Detail transition areas with Sto RapidGuard or StoGuard Conformable Membrane to achieve air and water—resistive barrier continuity. For illustrations of installation, refer to Sto Guide Details, Sto RapidGuard Installation Guide and StoGuard Conformable Membrane Installation Guide (www.stocorp.com).
- C Rough Opening Protection (select 1, 2, 3, or 4 for frame construction; for concrete or concrete masonry rough openings with wood bucks and similar openings with complex 3—dimensional geometry, select no. 3, Sto RapidGuard):
 1. Sto Gold Fill with StoGuard Mesh: apply 9 inch (229 mm) wide StoGuard Mesh at rough openings. Immediately apply Sto Gold Fill by spray or trowel over the mesh and spread smooth with a trowel to completely cover the mesh. For deep section studs use minimum 4 inch (102 mm) wide strips of StoGuard Mesh to seal sill and head to jamb corners. Crease and center the mesh at the sill/head to jamb intersection, press into place and apply Sto Gold Fill over the mesh (refer to Sto Detail 20.20M).
 2. Sto Gold Coat with StoGuard Fabric: apply Sto Gold Coat liberally by spray or roller to corners of openings, immediately place StoGuard RediCorners in the wet coating, and apply additional coating over the RediCorners to completely embed them. For deep section studs cut minimum 4 inch (102 mm) strips of StoGuard Fabric to seal sill and head to jamb corners. Crease and center the fabric strips at the sill/head to jamb intersection and embed the fabric strips in Sto Gold Coat. After all corners have been completed apply Sto Gold Coat liberally to the entire rough opening, immediately place StoGuard Fabric in the

wet coating, smooth any wrinkles with a brush or roller, and apply additional coating over the fabric to completely embed it. Overlap all seams minimum 2 inches (51 mm). Once completed, top coat with additional coating as needed to completely seal the surface. Allow to dry and inspect for pinholes or voids. If pinholes or voids are present, seal with additional coating or Sto RapidGuard.

3. Sto RapidGuard: apply a fillet bead of material with a caulking gun at interior corners inside the opening to seal jamb/sill and jamb/head seams. Apply material in a zig-zag pattern along sill, jambs, and head to form a generous bead of material along the surface to be covered. Use a 6 inch (152 mm) wide plastic drywall knife or spreader tool to spread the material to a uniform thickness of 12–20 mils (0.3–0.5 mm) before the material skins. Treat the entire rough opening surface in this manner and overlap onto the face of the sheathing 2 inches (51 mm) minimum all the way around
4. StoGuard Conformable Membrane: install the membrane in conformance with manufacturer's written installation instructions.

D Sheathing Joint Treatment (select one)

1. Sto Gold Fill with StoGuard Mesh: place 4 inch (102 mm) wide mesh centered along sheathing joints and minimum 9 inch (229 mm) wide mesh centered and folded at inside and outside corners. Immediately apply Sto Gold Fill by spray or trowel and spread smooth with a trowel to completely cover the mesh.

E Air and Water—Resistive Barrier Coating Installation

1. Install the specified coating to the required wet film thickness as specified by Substrate, Medium—Build, or High—Build (refer to Section 2.2B)

F Air and Water—Resistive Barrier Connections and Shingle Laps

1. Coordinate installation of connecting air and water—resistive barrier components with other trades to provide a continuous air tight membrane.
2. Coordinate installation of flashing and other moisture protection components with other trades to achieve complete moisture protection such that water is directed to the exterior, not into the wall assembly, and drained to the exterior at sources of leaks (windows, doors and similar penetrations through the wall assembly).
3. Splice—in head flashings above windows, doors, floor lines, roof/sidewall step flashing, and similar locations with StoGuard detail component to achieve shingle lap of the air and water—resistance.

3.05 STARTER TRACK AND BACK MOUNT CASING BEAD ACCESSORY INSTALLATION

- A** Strike a level line at the base of the wall to mark where the top of the starter track terminates.

- B Attach the starter track even with the line onto the structure a maximum of 16 inches (406 mm) on center with the proper fastener: Type S-12 corrosion resistant screws for steel framing with minimum 3/8 inch (9 mm) penetration, and galvanized or zinc coated nails for wood framing with minimum 3/4 inch (19 mm) penetration. Blocking installed between the studs may be necessary to secure the track flat against the wall surface. For solid sheathing attach directly into sheathing at 12 inches (305 mm) on center maximum.
- C Butt sections of starter track together. Miter cut outside corners and abut. Snip front flange of one inside corner piece (to allow the cement board to be seated inside of track) and abut.
- D Install Starter Track at other cement board system terminations as designated on detail drawings: above windows and doors, at floor lines, above roof along dormers or gable end walls, and beneath window sills with concealed flashing.
- E Install casing beads similarly at cement board stucco termination points—window and door jambs and other through wall penetrations. Install back-to-back casing beads at building expansion joints, thru-wall joints, where the cement board stucco abuts dissimilar construction or substrates, at changes in building height, at floor lines, columns, and cantilevered areas. Install full accessory pieces where possible and avoid small pieces. Where casing bead is used back-to-back as an expansion joint back the membrane with StoGuard Conformable Membrane.
- F Splice—in starter track at base of wall, above windows, doors, floor lines, roof/sidewall step flashing, and similar locations with StoGuard detail component to achieve shingle lap of the air and water—resistive barrier such that water is directed to the exterior.

3.06 DRAINAGE MAT INSTALLATION

- A Place drainage mat against the wall surface and unroll horizontally with the fabric facing out. Staple into place with corrosion-resistant fasteners. Use as few fasteners as needed to hold the mat in place, starting from the bottom of the wall at the starter track and working up. Do not fasten through flashing. Shingle lap fabric at horizontal courses. Shingle lap drainage mat over starter track and flashing at floor lines, decks, roof lines, window heads, and other areas where flashing is required, to direct water to the exterior. Butt ends of rolls and vertical seams. Trim at accessories around windows, doors, vents, or other penetrations through the wall. Do not install behind window nail flanges or accessories. Lap over back leg of installed accessories. Immediately follow installation of drainage mat with cement board stucco installation. Where cement board stucco installation will not immediately follow installation of drainage mat, use corrosion-resistant cap nails, cap staples, or cap screws every 16 inches (406 mm) on center along framing for more secure attachment. Cover drainage mat with cement board within 30 days of installation.

3.07 CEMENT BOARD STUCCO INSTALLATION

- A. After satisfactory inspection of surfaces and correction of any deviations from specification requirements commence the cement board stucco installation as described below. Ensure the installed cement board surface is straight and true within ¼ inch in 10 feet (2 mm/m), and is clean, dry and free from damage, frost, and all bond—inhibiting materials before application of coatings or accessories to cement board surface. Ensure the installed base coat or primed base coat surface is clean, dry, free from damage, frost, and all bond inhibiting materials, including dust, dirt, salts, oil, grease, or laitance, before application of finish.

1. Cement Board Installation

- a. Install cement board horizontally or vertically. Offset joints from sheathing joints by minimum six inches (152 mm). Insert bottom edge of board into the starter track, and then attach the board through the sheathing to studs/framing members with fasteners spaced 8 inches (203mm) on center maximum at the perimeter and in the field of the board, making sure that the fasteners seat flush with the surface of the cement board and do not penetrate the surface of the cement board.
- b. Install cement boards with vertical joints staggered and with ends and edges closely butted but not forced together and flush at the surface. Cut boards in an “L” shape around openings such as windows, doors, and similar penetrations.
- c. Provide for expansion joints and control joints in cement board layout (see Design Requirements, Section 1.04).

2. Face Mount Accessory Installation

- a. Install one piece control joints at wall penetrations, for example, above and below windows and doors. Refer to Sto Tech Hotline No. 0307—S. Install control joints in accordance with the following guidelines:
 - 1) Light colors (LRV > 70) – at no greater than 25 ft (7.6 m) intervals and 625 ft² (58 m²)
 - 2) Dark colors (LRV < 70 and > 30) – at no greater than 16 ft (4.68 m) intervals and every 256 ft² (23.5 m²)
 - 3) Do not exceed length to width ratio of 2–1/2:1 in expansion joint layout.
- b. Inside Corners: install corner bead accessory at inside corners adhesively or mechanically. Refer to Sto Tech Hotline No. 0307—S.
- c. Outside Corners: install corner bead accessory adhesively by completely embedding the accessory in the base coat material. Refer to Sto Tech Hotline No. 0307—S

- d. Drip Edge: install drip edge accessory by completely embedding the accessory in the base coat material. Refer to Sto Tech Hotline No. 0307—S, Accessories for StoQuik Silver Cement Board Stucco Systems..
- 3. Cement Board Joint Reinforcement, Accessory Overlaps, and Corners of Wall Penetrations
 - a. Install StoGuard Mesh centered over cement board joints. After placing mesh over joints skim coat the surface with base coat to completely cover the mesh.
 - b. Install StoGuard Mesh over perforated accessory flanges up to the “stop bead” on the accessory – starter tracks, casing beads, corner beads, and control joints. After placing mesh over flanges skim coat the surface up to the “stop bead” on the accessory with base coat to completely cover the mesh.
 - c. At corners of wall penetrations where no control joint is used embed 9 x 12 inch (230 x 305 mm) detail mesh diagonally in base coat.
- 4. Foam Trim and Build—Outs
 - a. Where foam build—outs terminate at a dissimilar material such as a window, door or other non— cement board stucco surfaces, backwrap the foam build—out by installing detail mesh onto the terminating edge of the cement board. Embed the mesh in the base coat. Allow the mesh to dangle until the backwrapping procedure is completed (B4).
 - b. Install foam build—outs directly over cement board with foam trim adhesive. Apply adhesive with the appropriate size notched trowel to the back of the insulation board and immediately place build—out in the proper location on the wall. Press firmly into place and trim or tool excess adhesive from ends and edges of foam trim for a smooth void—free connection to the cement board substrate.
 - c. After the adhesive has cured sufficiently to hold the build—out firmly in place, rasp the entire foam surface smooth.
 - d. Complete the backwrapping procedure by applying the foam trim base coat to the exposed edges of the foam build—out and minimum 2—1/2 inches (64 mm) onto the face. Pull the backwrap mesh around the foam build—out and fully embed it into the base coat. Use a corner trowel for neat straight corners.
 - e. Apply the base coat to the foam build—out and approximately 3 inches (76 mm) onto the adjacent cement board surfaces to an approximate thickness of 1/8 inch (3 mm). Immediately embed the reinforcing mesh in the wet base coat. Trowel from the center to the edges of the mesh to avoid wrinkles and remove excess base coat. Overlap mesh seams minimum 2—1/2 inches (64 mm). Overlap mesh onto adjacent cement

board wall surfaces minimum 2—1/2 inches (64 mm) at terminations of the foam build—out and feather onto the cement board wall surface.

5. Reinforced Base Coat Installation

- a. Apply base coat over the cement board, including any areas of unreinforced foam trim/build—outs, with a stainless steel trowel to a uniform thickness of approximately 1/8 inch (3 mm). Work horizontally or vertically in strips of 40 inches (1016mm), and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2—1/2 inches (64 mm) at mesh seams and fully overlap mesh at accessories to the accessory “stop bead.” Fully overlap backwrap reinforcing mesh along foam trim/build—outs if these surfaces have not yet been reinforced with base coat/mesh. Feather seams and edges. Double wrap all inside and outside corners with minimum 8 inch (203 mm) overlap in each direction where mesh is used in lieu of a corner bead accessory. Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re— skim with additional base coat if mesh color is visible or if necessary to correct planar irregularities in the wall surface. Allow base coat to thoroughly dry before applying primer or finish.
- b. Sloped Surfaces: for foam trim, reveals, aesthetic bands, cornice profiles, sills or other architectural features that project beyond the vertical wall plane more than 2 inches (51 mm) apply waterproof base coat with a stainless steel trowel to the weather exposed sloped surface and minimum four inches (100 mm) above and below it. Embed standard mesh or detail mesh in the waterproof base coat and overlap mesh seams a minimum of 2—1/2 inches (65 mm). Allow base coat to thoroughly dry before applying primer or finish.

6. Primer Installation

- a. Apply primer evenly by brush or roller to the dry base coat surface

7. Textured Finish Installation

- a. Apply finish to base coat or primed base coat and foam build—outs. Apply finish by spraying or troweling with a stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:
- b. Avoid application in direct sunlight.
- c. Apply finish in a continuous application and work a wet edge towards the unfinished wall area. Work to an architectural break in the wall before stopping to avoid cold joints.

- d. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
 - e. Float “R” (rilled or swirl texture) finishes with a plastic float to achieve their rilled texture
 - f. Do not install separate batches of finish side—by—side.
 - g. Do not apply finish into or over sealant joints. Apply finish to outside face of wall only.
 - h. Do not apply finish over irregular or unprepared surfaces or surfaces not in compliance with the requirements of the project specifications.
 - i. Do not install finish over high pH (> 10) stucco surfaces or surfaces that have not been fully cured.
8. Sto Signature or Specialty Finish Installation
- a. Refer to applicable Installation Guide and/or Product Bulletin for selected finish.
9. Sto Custom Cast Finish Installation
- a. Refer to applicable Application Guide and/or Product Bulletin for selected finish.

3.08 PROTECTION

- A Provide protection of installed materials from water infiltration into or behind them.
- B Provide protection of installed materials from dust, dirt, precipitation, and freezing.
- C Provide protection of installed primer and finish from dust, dirt, precipitation, freezing and continuous high humidity until fully dry.
- D Provide sealant and backer material at cement board stucco terminations and at fixture penetrations through the cement board stucco to protect against air, water and insect infiltration. Provide weeps at floor lines, window and door heads, and other areas to conduct water to the exterior.

3.09 CLEANING AND MAINTENANCE

- A Clean and maintain the cement board stucco finish for a fresh appearance and to prevent water entry into and behind the assembly. Repair cracks, impact damage, spalls or delamination promptly.
- B Maintain adjacent components of construction such as sealants, windows, doors, and flashing, to prevent water entry into the wall assembly.
- C Refer to Sto reStore Repair and Maintenance Guide (reStore Program) for detailed information on restoration – cleaning, repairs, recoating, resurfacing and refinishing, or re—cladding.

END OF SECTION

SECTION 072500 - WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor-permeable, fluid-applied air barriers.

1.02 RELATED REQUIREMENTS

- A. Section 072100 - Thermal Insulation
- B. Section 076200 - Sheet Metal Flashing and Trim

1.03 DEFINITIONS

- A. Weather Resistive Barriers: Materials or assemblies forming water-resistive barriers, air barriers, vapor retarders, or a combination of one or more assemblies.

1.04 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- C. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.
- D. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics and performance criteria.
- C. Shop Drawings:
 - 1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of the barrier.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies

shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.02 WATER-RESISTIVE BARRIERS

- A. High-Build, Vapor-Permeable Air Barrier: synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

- 1. Synthetic Polymer Type:

- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier VPL.
 - 2) Henry Company, Sealants Division; Air-Bloc 31MR.
 - 3) Tremco Incorporated; ExoAir 230.

- 2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
- b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
- c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
- d. Adhesion to Substrate: Minimum 30 lbf/sq. in. when tested according to ASTM D 4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.03 ACCESSORIES

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Openings and Penetrations in Exterior Weather Resistive Barriers:
 - 1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 - 3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
 - 4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
 - 5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 074213 - COMPOSITE METAL WALL PANELS

PART 1 GENERAL

1.01 SCOPE

- A. Section Includes:
 - 1. MCM - Fire Resistant Composite Metal Panels.
 - 2. Panel systems requirements of composite fire resistive panels including exterior and interior installation assemblies, components, and accessories.
- B. Related Sections:
 - 1. Division 05 Metal Framing Sections.
 - 2. Division 07 Air and Vapor Barrier.
 - 3. Division 07 Flashing and Trim Sections.
 - 4. Division 07 Joint Treatment Section.
 - 5. Division 08 Aluminum Windows Section.
 - 6. Division 08 Glass and Glazing Section.
 - 7. Division 08 Curtain Wall Sections.

1.02 REFERENCE STANDARDS

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed have either been identified by the International Building Code (IBC), local building code, or specific requirement for this building construction type.
- B. Aluminum Association (AA):
 - 1. Aluminum Design Manual.
 - 2. AA-M12C22A41: Anodized - Clear Coating.
 - 3. AA-M12C22A44: Anodized - Color Coating.
- C. American Society for Testing and Materials (ASTM) International:
 - 1. ASTM D1781 Standard Test Method for Climbing Drum Peel for Adhesives.
 - 2. ASTM D1929 Standard Test Method for Determining Ignition Temperature of Plastics.
 - 3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 4. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - 5. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 - 6. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Curtain Wall, and Doors By Uniform Static Air Pressure Difference.
- D. American Architectural Manufacturers Associations (AAMA):

1. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 2. AAMA 509 Voluntary Test and Classification Method of Drained and Back Ventilated Rain Screen Wall Cladding Systems.
- E. National Fire Protection Association (NFPA):
1. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
1. Provide installed MCM system designed to withstand specified loadings while maintaining allowable deflection and thermal movement performance as defined by the Manufacturer.
 2. Deflection and Thermal Movement: Provide installed MCM systems that have been designed to resist wind loading, acting inward and outward.
 3. Perimeter Framing Deflection: Deflection of panel perimeter framing member shall not exceed $L/175$ normal to plane of the wall where L is the unsupported span of the perimeter framing member.
 4. Panel Deflection: Deflection of the panel face shall not exceed $L/60$ at design load where L is the unsupported span of the panel.
 5. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 0.0625 in (1.6mm).
 6. Thermal Movements: Allow for free and noiseless horizontal and vertical thermal movement due to expansion and contraction of component parts over a temperature range of -20°F (-29°C) to $+180^{\circ}\text{F}$ (82.2°C) at the material surface.
 7. Buckling, opening of joints, undue stress on fasteners, failure of sealants, or any other detrimental effects of thermal movement will not be permitted.
 8. Fabrication, assembly and erection procedures shall take into account the ambient temperature range at the time of the respective operation.
- B. Water and Air Leakage: Provide systems that have been tested and certified to conform to the following criteria:
1. Air Leakage, ASTM E283: Not more than 0.06 cfm per ft^2 of wall area (0.003 L/s m^2) when tested at 1.57 psf (0.075 kPa).
 2. Water Penetration: No water infiltration under static pressure when tested in accordance with ASTM E331 at a differential of 10% of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.
 3. Water penetration is defined as the appearance of uncontrolled water in the wall.

4. Wall design shall feature provisions to drain to the exterior face of the wall any leakage of water at joints and any condensation that may occur within the construction.
- C. Structural: Provide systems that have been tested in accordance with ASTM E330 at a design pressure of [specify design pressure in psf (kPa)] and have been certified to be without permanent deformation or failures of structural members.
- D. Fire Performance: Provide composite fire rated panels that have been evaluated and are in compliance with regulatory code agency requirements specified herein.

1.04 SUBMITTALS

- A. Submit in accordance with Conditions of the Contract and Division 01 Submittal Procedures Sections.
- B. Submit product data, including manufacturer's brochures and Spec-Data Sheets.
- C. Shop Drawings: Submit shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants, and gaskets, including joints necessary to accommodate thermal movement; trim; flashing; and accessories.
- D. Samples: Submit selection and verification samples for finishes, colors and textures.
 1. Selected Samples: Manufacturer's color charts or chips illustrating full range of colors, finishes and patterns available for composite metal panels with factory applied finishes.
 2. Verification Samples:
 3. Panel System Assembly: Two samples of each assembly 12 in x 12 in (304mm x 304mm).
 4. Two samples of each color in coil coated, or draw down samples on aluminum substrate, not less than 3 in x 4 in (76mm x 102mm).
- E. Quality Assurance Submittals:
 1. Product Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties, or a third-party listing documenting compliance to a comparable code section.
 2. Product Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.
 3. Manufacturer's Product Literature.
 4. Manufacturer's Field Reports.
- F. Closeout Submittals:
 1. Warranty: Warranty documents specified herein.

1.05 QUALITY ASSURANCE

- A. MCM Manufacturer Qualifications:
 1. Company with a minimum of 10 years of continuous experience manufacturing MCM of the type specified.
 2. Able to provide specified warranty on finish.

3. Able to provide a list of other projects of similar size, including approximate date of installation and name of Architect for each.
 4. Able to produce the composite material without outsourcing of the fire-resistant core manufacture and compounding, or panel bonding process.
- B. MCM Fabricator Qualifications:
1. MCM system fabricator will have at least three (3) years of continuous documented experience fabricating the panel material type specified.
 2. MCM system fabricator will have been in business under its present name for at least five (5) years prior to the start of this project.
 3. MCM system fabricator will be capable of providing field service representation during construction.
 4. MCM system fabricator will not have filed for protection from creditors under state or federal insolvency or debtor relief statutes or codes.
- C. MCM System Installer Qualifications:
1. MCM system installer will have been in business under its present name for at least five (5) years prior to the start of this project and have experience with similar sized MCM system projects.
 2. MCM system installer will be capable of providing field service representation during construction.
 3. The MCM System Installer must be an approved installer by the MCM Fabricator for the installation of their MCM System and have undergone proper training for the specified system thereof.
- D. Mock-Up:
1. At location on building and to extent directed by Architect, install areas of specified wall panels, support framing, flashing, trim and accessories to demonstrate substrate preparation, support framing, furring and flashing, clearances and gaps between members, fastening methods, trim details, joint protection, and workmanship.
 2. Prepare mock-up for Architect's approval before start of wall panel work. Prepare additional mock-ups, if required by Architect, until approved.
 3. Maintain approved mock-up during construction to establish required standard of workmanship and basis of comparison for installation of wall panel work. Approved mock-up may remain as part of finished work.
- E. Installation Documents On-Site: Maintain copies of installation instructions, approved submittal and other execution related documents on-site; make available as needed to confirm proper installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Adhere to manufacturer's ordering instructions and lead time requirements to avoid delays.
- B. Deliver materials to fabricator in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect finish of panels by applying heavy-duty removable plastic film during production.
- D. After fabrication, package composite wall panels for protection against transportation damage.
- E. Store material in accordance with manufacturer's guidelines.
- F. Exercise care unloading, storing and installing panels to prevent bending, warping, twisting and surface damage to the factory applied finish.
- G. Store materials protected from exposure to harmful weather conditions, out of direct sunlight when unpackaged, and at temperatures not to exceed 120°F.
- H. Protect panels from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
- I. Slope panels to ensure positive drainage of any accumulated water.
- J. Avoid contact with any other materials that might cause staining, denting or other surface damage to the factory applied finish.

1.07 WARRANTY

- A. Manufacturer's Warranties: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
- B. Warranty Periods:
 - 1. Panel Integrity: 10 Years commencing on Date of Substantial Completion.
 - 2. Painted Finish: 30 Years commencing on Date of Substantial Completion.
 - 3. MCM Natural Metals: No finish warranty.
 - 4. Anodized Finish: 5 Years commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE RESISTANT METAL COMPOSITE MATERIAL (MCM)

- A. Fire Resistant Metal Composite Material (MCM) Manufacturer:
 - 1. Alfrex, Inc., 943 Gainesville Hwy. Bldg 100-4000, Buford, GA 30518; Phone: (470) 589-7449; Website: www.alfrexusa.com; Email: alfrex@alfrexusa.com.

2.02 BASIS OF DESIGN

- A. Alfrex FR - Metal Composite Material.
- B. Description: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic fire-resistant material formed in a continuous process with no glues or liquid adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain

foamed insulation material. Products that are laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

- C. MCM Thickness:
 - 1. 4mm (0.157 in).
 - 2. 6mm (0.236 in).
- D. MCM Face Sheets:
 - 1. Front Face: 0.5mm (0.020 in) nominal.
 - 2. Fire Resistant Mineral Core: 3.0mm (0.117 in) nominal - 4mm FR panel; 5.0mm (0.197 in) nominal - 6mm FR panel.
 - 3. Back Face: 0.5mm (0.020 in) nominal.
 - 4. Aluminum Alloy: 3003-H14.
- E. Weight:
 - 1. 4mm: 1.51 lb/ft² (7.37 kg/m²).
 - 2. 6mm: 2.13 lb/ft² (10.40 kg/m²).

2.03 FINISHES

- A. Coil coated KYNAR® 500 or HYLAR® 5000 based Polyvinylidene Fluoride (PVDF) or Fluoro Ethylene - Alkyl Vinyl Ether (FEVE) resin in conformance with AAMA 2605.
- B. Color: Select one of the following:
 - 1. Standard color as selected by the Owner/Architect/Engineer from manufacturer's standard color selection: 2 Coat Solid, 2 Coat Mica, or 3 Coat Metallic.
 - 2. Custom color to be matched by the panel supplier: 2 Coat Solid, 2 Coat Mica, or 3 Coat Metallic.
 - 3. Clear coat over hairline aluminum substrate.
- C. Dry Film Thickness:
 - 1. 2 Coat: 1.0 mil (±0.2 mil).
 - 2. 3 Coat: 1.0 mil (±0.2 mil) + 0.50 mil (±0.05 mil).
- D. Hardness: ASTM D3383; HB minimum using Eagle Turquoise Pencil.
- E. Impact Resistance: Test method ASTM D2794; Gardner Variable Impact Tester with 5/8 inch mandrel. Coating shall withstand reverse impact of 1.5 in-lbs per mil substrate thickness. Coating shall adhere tightly to metal when subjected to #600 Scotch Tape pick-off test.
- F. Adhesion: Test Method ASTM D3359; coating shall not pick-off when subjected to an 11 in x 11 in x 1/16 in grid and taped with #600 Scotch Tape.
- G. Humidity Resistance: Test Method ASTM D2247; no formation of blisters when subject to condensing water fog at 100% relative humidity and 100°F for 4000 hours.

- H. Salt Spray Resistance: Test Method ASTM B117; expose coating system to 4000 hours using 5% NaCl solution. Corrosion creepage from scribe line: 1/16 inch maximum. Minimum blister rating of 8 within the test specimen field.
- I. Weather Exposure: 10 year exposure at 45° angle facing south Florida. Maximum color change of 5 Delta E units per ASTM D2244. Minimum chalk rating of 8 per ASTM D4214. No checking, crazing, or adhesion loss.
- J. Chemical Resistance:
 - 1. ASTM D1308 utilizing 10% Muriatic Acid for an exposure time of 15 minutes. No loss of film adhesion or visual change when viewed by the unaided eye.
 - 2. ASTM D1308 utilizing 20% Sulfuric Acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by the unaided eye.
 - 3. AAMA 2605 utilizing 70% reagent grade Nitric Acid vapor for an exposure time of 30 minutes. Maximum color change of 5 Delta E units per ASTM D2244.

2.04 ALTERNATES

- A. Base Bid/Contract Manufacturer: [Specify base bid/contract manufacturer].
 - 1. Product: [Specify product base bid/contract brand/trade name with product attributes and characteristics].
- B. Alternate No. [Specify #]: [Specify alternate manufacturer].
 - 1. Product: [Specify product alternate brand/trade name with product attributes and characteristics].

2.05 MCM PRODUCT PERFORMANCE

- A. Bond Integrity: Tested for resistance to delamination as follows:
 - 1. Peel Strength (ASTM D1781): 22.5 in-lb/in (100 N-m/m) minimum.
 - 2. No degradation in bond performance after 8 hours of submersion in boiling water at 212°F (100°C).
 - 3. No degradation in bond performance after 21 days of immersion in water at 70°F (21°C).
 - 4. Thermally bonded to the fire-resistant core material in a continuous process under tension.
- B. Fire Performance:
 - 1. Flamespread, ASTM E84: Less than 25.
 - 2. Smoke Developed, ASTM E84: Less than 450.
 - 3. Surface Flammability, Modified ASTM E108: Pass.
 - 4. Ignition Temperature, Flash, ASTM D1929: 716°F (380°C); Ignition: 752°F (400°C).
 - 5. Flammability, Exterior Non-Load-Bearing Wall Assemblies and Panels, NFPA 285: Pass.
- C. Production Tolerances:
 - 1. Width: ± 0.157 in (4.0mm).
 - 2. Length: $+ 0.394$ in (10mm).

3. Thickness (4mm Panel): ± 0.008 in (0.2mm).
4. Thickness (6mm Panel): ± 0.012 in (0.3mm).
5. Bow: Maximum 0.2% of length or width.
6. Squareness: Maximum 0.197 in (5mm).

2.06 FABRICATION

- A. General: Shop fabricate to sizes and joint configurations indicated on drawings.
- B. Fabricate panels to dimensions indicated on drawings based on an assumed design temperature of 70°F (21°C). Allow for ambient temperature range at time of fabrication.
- C. Formed MCM panel lines, breaks and angles to be sharp and true, with surfaces that are free from warp or buckle.
- D. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
- E. Fabrication Tolerances:
 1. Width: ± 0.079 in [± 2.0 mm] @ 70°F (21°C).
 2. Length: ± 0.079 in [± 2.0 mm] @ 70°F (21°C).
 3. Squareness: ± 0.079 in [± 2.0 mm] @ 70°F (21°C).

PART 3 EXECUTION

3.01 METAL PANEL FABRICATOR AND INSTALLER INSTRUCTIONS

- A. Compliance: Comply with product data, including product technical bulletins, product catalog installation instructions, and product carton instructions.

3.02 EXAMINATION AND PREPARATION

- A. Verify that conditions of substrates previously installed under other sections or divisions are acceptable for metal panel rainscreen system installation. Documentation should be provided indicating any conditions detrimental to the performance or installation of the metal wall panel rainscreen system.
- B. Notify Architect of unacceptable conditions once discovered.
- C. Proceed with preparation and installation only after unacceptable conditions have been corrected.
- D. Field Measurements:
 1. If required per project conditions, field measurements of the site conditions are to be taken prior to beginning fabrication work. Notification of any material modifications and resulting schedule adjustments shall be formally documented.
 2. Field measurements are to be made once all substrate and adjacent materials are installed, verifying the locations of wall framing members and wall opening dimensions before commencement of installation. Indicate measurements on the As-Built Shop Drawings.

3. Project Schedule: Provisions in the project schedule must accommodate the time interval between field measurements and fabrication/installation.
- E. Miscellaneous Framing: Install miscellaneous MCM system support members and anchorage according to MCM System written instructions and drawings supplied by the MCM System Fabricator.

3.03 INSTALLATION

- A. General:
 1. Install panels plumb, level and true in compliance with fabricator's recommendations.
 2. Anchor panels securely in place in accordance with fabricator's approved shop drawings.
 3. Comply with fabricator's instructions for installation of concealed fasteners and with provisions of Section 079000 for installation of joint sealers.
- B. Installation Tolerances: Maximum deviation from horizontal and vertical alignment of installed panels: 0.25 in in 20 ft (6.4mm in 6.1m), noncumulative.
- C. Separate contact of dissimilar metals with bituminous paint, approved plastic shims, or other approved methods as defined within the Aluminum Design Manual (ASD). Use gasketed or approved coated fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.
- D. Related Products: Refer to related sections specified herein for related materials, including cold-form metal framing, flashing and trim, joint sealants, aluminum windows, glass and glazing, and curtain walls.

3.04 FIELD QUALITY REQUIREMENTS

- A. Field Quality Control: Comply with panel system fabricator's recommendations and guidelines for field forming of panels.
- B. Field Quality Control: When required by contract, mock-up shall be constructed and tested at the expense of the Architect/Owner/General Contractor.
- C. Testing Agency: If required, the Owner shall engage a qualified testing agency to perform tests and inspections.
- D. Fabricator's Field Services: Upon Owner's request, provide fabricator's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with fabricator's instructions.

3.05 ADJUSTING AND CLEANING

- A. Adjusting:
 1. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement are the responsibility of the General Contractor.

2. Removal of panels damaged by other trades is the responsibility of the General Contractor.
 3. Repair components of the MCM system that present with minor damage provided said repairs are not visibly apparent at a distance of 10 ft (3m) from the surface at a 90° angle per AAMA 2605.
 4. Remove and replace components of the MCM system damaged beyond repair.
 5. Remove protective film immediately after installation of MCM panels and immediately prior to completion of the MCM system work.
 6. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
 7. Promptly remove from the job site any damaged MCM panels, protective film, and other debris attributable to MCM system installation, and legally dispose of said materials.
- B. Cleaning: After MCM system installation remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

3.06 PROTECTION

- A. Protect installed products from damage during subsequent construction work until final inspection and acceptance by Owner.

END OF SECTION

SECTION 075400 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Cover boards.
- D. Flashings.
- E. Roofing stack boots, roofing expansion joints, and walkway pads.

1.02 REFERENCE STANDARDS

- A. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board; 2017a (Reapproved 2022).
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- D. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
- E. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2024.
- F. NRCA (RM) - The NRCA Roofing Manual; 2024.
- G. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.
- C. Store materials in weather protected environment, clear of ground and moisture.
- D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- E. Protect foam insulation from direct exposure to sunlight.

1.06 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.07 WARRANTY

- A. See Section 017000 - Closeout Requirements for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years.
 - 2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
 - 1. Carlisle SynTec Systems

2. GAF
 3. IKO Industries Inc
 4. Johns Manville
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation:
1. BASF Corporation
 2. Carlisle SynTec Systems
 3. DuPont de Nemours, Inc
 4. GAF
 5. Johns Manville
 6. Owens Corning Corporation
- C. Cover Boards:
1. Johns Manvill
 2. Georgia-Pacific
 3. Gold Bond Building Products, LLC provided by National Gypsum Company
 4. Substitutions: See Section 016000 - Product Requirements.

2.02 ROOFING

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Requirements:
1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
 - a. Calculate SRI in accordance with ASTM E1980.
 - b. Field applied coating may not be used to achieve specified SRI.
- C. Acceptable Insulation Types - Constant Thickness Application:
1. Minimum 2 layers of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application:
1. Tapered polyisocyanurate or perlite board.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

- A. Membrane Roofing Materials:
1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
 - a. Thickness: 60 mil, 0.060 inch, minimum.
 2. Sheet Width:
 - a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.

3. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Fasteners: As recommended and approved by membrane manufacturer.
- D. Flexible Flashing Material: Same material as membrane.
- E. Through-Wall Flashing: Cold-applied, self-adhering, styrene-butadiene-styrene (SBS) modified rubberized asphalt sheet membrane bonded with high density cross-woven polyethylene film.
 1. Thickness: 47 mil, 0.047 inch, minimum.
 2. Width: 12 inches, minimum.
- F. Through-Wall Flashing with Termination Bar: At least 40 mil, 0.040 inch thick poly-reinforced membrane with extruded termination bar and drip-edge.
 1. Width: 18 inches, minimum.
- G. Separation Sheet: Sheet polyethylene; 2 mil, 0.002 inch thick.
- H. Water-Pervious Fabric: Woven polyethylene, UV-stabilized, open to moisture movement, black.

2.04 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 1. Thickness: 1/2 inch, fire-resistant.

2.05 INSULATION

- A. Perlite Board Insulation: Expanded perlite mineral aggregate, complying with ASTM C728.
 1. Board Size: 24 by 48 inches.
 2. Board Thickness: 1/2 inch.
 3. Tapered Board: Slope as indicated; minimum thickness ____ inch; fabricate of fewest layers possible.
- B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 1. Classifications:
 - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
 - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
 - 2) Compressive Strength: Classes 1-2-3, Grade 1, 16 psi (110 kPa), minimum.
 - 3) Thermal Resistance, R-value 8.6: At 1-1/2 inches thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F.
 2. Board Size: 48 by 96 inches.
 3. Board Thickness: 1.5 inches.
 4. Assembly thickness to achieve R-25 ci per IECC 2021

2.06 ACCESSORIES

- A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.
- B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- C. Sheathing Joint Tape: Heat resistant type, self adhering.
- D. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.
- E. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
- F. Membrane Adhesive: As recommended by membrane manufacturer.
- G. Insulation Adhesive: As recommended by insulation manufacturer.
- H. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.
- I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 - 1. Composition: Asphaltic with mineral granule surface.
 - 2. Size: 18 by 18 inches.
 - 3. Surface Color: Yellow.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSTALLATION, GENERAL

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.03 INSTALLATION - MEMBRANE

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate of ____ gallons per square foot. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Install roofing expansion joints where indicated. Make joints watertight.
 - 1. Install prefabricated joint components in accordance with manufacturer's instructions.
- H. Coordinate installation of roof drains and sumps and related flashings.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing in accordance with requirements.
- C. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.05 CLEANING

- A. See Section 017000 - Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 076200 – SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Fabricated sheet metal items, including flashings and counterflashings.
- B Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A Section 079200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- C ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
- D ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- F ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- G ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.
- H ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- I SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SECTION REQUIREMENTS

- A Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and noncorrosive installation.

1.05 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 one samples, 24 by 24 inch in size illustrating material, finish, and fabrication details of typical standing seam.

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.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.
- B Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.
- C Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) (0.81 mm) thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.
- D Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) (0.40 mm) thick; smooth No. 4 - Brushed finish.
- E Copper: ASTM B370, cold rolled 16 oz/sq ft (24 gage) (0.0216 inch) (0.55 mm) thick; natural finish.

2.02 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 (13 mm); miter and seam corners.
- D Form material with flat lock 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 (450 mm) long legs; seam for rigidity, seal with sealant.
- F Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 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: Galvanized steel, with soft neoprene washers.
- C Primer: Zinc chromate type.
- D Concealed Sealants: Non-curing butyl sealant.
- E Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

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 Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A Comply with drawing details.
- B Comply with SMACNA's "Architectural Sheet Metal Manual." Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.
 - 1. Roof-Edge Flashings: Secure metal flashings at roof edges according to FMG Loss Prevention Data Sheet 1-49 for specified wind zone.

- C Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- D Fabricate nonmoving seams in sheet metal with standing seams. For aluminum, form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 1. Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, unless pre-tinned surface would show in finished Work.
- E Separation: Separate non-compatible metals or corrosive substrates with a coating of asphalt mastic or other permanent separation.
- F Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- G Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- H Apply plastic cement compound between metal flashings and felt flashings.
- I Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- J Connect downspouts to downspout boots storm sewer system, and grout seal connection watertight.

3.04 FIELD QUALITY CONTROL

- A See Section 014000 - Quality Requirements, for field inspection requirements.
- B Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof curbs
- B. Equipment rails
- C. Roof penetrations mounting curbs
- D. Roof hatches with access ladders

1.02 REFERENCE STANDARDS

- A. 29 CFR 1910.23 - Ladders; Current Edition.
- B. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.
- C. 29 CFR 1926.502 - Fall protection systems criteria and practices; Current Edition.
- D. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.
- I. ASTM B69 - Standard Specification for Rolled Zinc; 2021.
- J. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- L. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- M. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
- D. Warranty Documentation:
 1. Submit manufacturer warranty.
 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store products under cover and elevated above grade.

1.05 WARRANTY

- A. See Section 017000 - Closeout Requirements for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

- A. Roof Curbs Manufacturers:
 1. Active Ventilation Products, Inc
 2. AES Industries Inc
 3. The Pate Company
 4. LMCurbs
 5. MKT Metal Manufacturing
 6. Substitutions: See Section 016000 - Product Requirements.
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
 2. Roof Curb Mounting Substrate: Curb substrate consists of flat roof deck sheathing with insulation.
 3. Sheet Metal Material:
 - a. Aluminum: 0.080 inch minimum thickness, with 3003 alloy, and H14 temper.

1) Finish: Mill finish.

- C. Roof Curb Caps: Square-type aluminum cap with weathertight seal when vent or equipment is not installed.
- D. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of curb.
 - 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
 - 3. Height Above Finished Roof Surface: 8 inches, minimum.
- E. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of rails.
 - 2. Height Above Finished Roof Surface: 8 inches, minimum.
- F. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

2.02 ROOF HATCHES AND LADDERS

- A. Roof Hatch with fixed ladder. 14 gauge Steel cover and Frame with integrated curb, gaskets, hinges, latch, lockable, with lift assistance.
- B. Roof Hatch Manufacturers:
 - 1. Bilco Company; Type S: www.bilco.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 - 1. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
 - 2. Curb Height: 12 inches from finished surface of roof, minimum.
- D. Metal Covers: Flush, insulated, hollow metal construction.
 - 1. Capable of supporting 40 psf live load.
 - 2. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
 - 3. Gasket: Neoprene, continuous around cover perimeter.

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.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

- A. Clean installed work to like-new condition.

3.05 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 078100 - APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applied fire protection of interior structural steel not exposed to damage or moisture.
- B. Applied fire protection of exterior structural steel exposed to moisture.
- C. Preparation of applied fire protection for application of exposed overcoat finish specified elsewhere.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- B. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).
- C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).
- D. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- E. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- F. ASTM E761/E761M - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- G. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.
- H. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics.
- C. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.
- D. Product Certificates: For each type of fireproofing.
- E. Evaluation Reports: For fireproofing, from third party.
- F. Preconstruction Test Reports: For fireproofing.
- G. Field quality-control reports.
- H. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. It is recommended that industry guidelines as noted in National Fireproofing Contractors Association (NFCA) 100-Standard Practice for the Application of Spray-Applied Fire Resistive Materials (SFRMs) be maintained on the project site.

1.07 MOCK-UP

- A. Construct mock-up
- B. Comply with project requirements for fire ratings
- C. Locate where directe
- D. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature, and humidity
- E. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary; remove materials and re-construct mock-up
- F. Mock-up may remain as part of the Work

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Applied Fire Protection:
 - 1. At interior locations: Isolatek International Corp; CAFCO 300 Series - BASIS OF DESIGN
 - 2. At exterior locations: Isolatek International Corp; CAFCO 400 Series – BASIS OF DESIGN
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 APPLIED FIRE PROTECTION ASSEMBLIES

- A. Provide assemblies as indicated on drawings.

2.03 MATERIALS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119/UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.
- E. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Asbestos: Provide products containing no detectable asbestos.
- G. Products shall possess DECLARE Label
 - 1. Declaration Status "LBC Red List Free"

2.04 SPRAY-APPLIED FIRE RESISTIVE MATERIALS:

- A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Concealed/Commercial SFRMs:

- a. ISOLATEK International: CAFCO® 300 Series (ISOLATEK® Type 300 Series), CAFCO® BLAZE-SHIELD® II (ISOLATEK® Type II)
- b. Physical Properties:
 - 1) Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 2) Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605.
 - 3) Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
 - 4) Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible.
 - 5) Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
 - a) Flame Spread Index [10] or less
 - b) Smoke Developed [10] or less
 - 6) Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf (68.9 kPa).
 - 7) Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 - 8) Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 - 9) Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 - 10) Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
 - 11) Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28
- 2. Medium Density SFRMs:
 - a. Isolatek International: CAFCO 400 (ISOLATEK® TYPE 400) Series, CAFCO® BLAZE-SHIELD® HP (ISOLATEK® TYPE HP)
 - b. Physical Properties:
 - 1) Bond Strength: Minimum 430-lbf/sq. ft. (20.59-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 2) Density: Not less than and 22 lb/cu. ft. (350 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605..

- 3) Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
- 4) Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible
- 5) Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
 - a) Flame Spread Index [10] or less
 - b) Smoke Developed [10] or less
- 6) Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf (351 kPa).
- 7) Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- 8) Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- 9) Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
- 10) Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
- 11) Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28 days with or without the use of a mold inhibitor.

2.05 AUXILIARY MATERIALS:

- C. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- D. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 - 1. Fireproofing manufacturer shall be contacted for procedures on handling primed/painted steel.
 - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- E. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- F. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- G. Reinforcing Fabric: Glass or carbon fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- H. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- I. Sealer: If required, a transparent-drying, water-dispersible, tinted protective coating as recommended by fireproofing manufacturer.
 - 1. Product: Subject to compliance with requirements, provide CAFCO® BOND-SEAL (ISOLATEK® Type EBS) or CAFCO® BOND-SEAL Type X (ISOLATEK® Type X) by ISOLATEK International.
- J. Topcoat: If required, a topcoat suitable for application over applied fireproofing; of type recommended by fireproofing manufacturer.
 - 1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.

- a. Product: Subject to compliance with requirements, provide CAFCO® FENDOLITE® M-II (ISOLATEK® Type M-II), CAFCO® FENDOLITE® TG (ISOLATEK® Type TG) by ISOLATEK International.
- K. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM. Provide application at a rate of [30 sq. ft./gal. (0.75 sq. m/L)] [60 sq. ft./gal. (1.5 sq. m/L)] [120 sq. ft./gal. (3 sq. m/L)].
 - a. Product: Subject to compliance with requirements, provide CAFCO® TOP-COTE (ISOLATEK® Type TOP-COTE) by ISOLATEK International.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing. Repair existing fireproofing using same method as original installation or trowel installation techniques recommended by manufacturer.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled.
- E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

- A. Apply primer adhesive in accordance with manufacturer's instructions.
- B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.04 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by Chapter 17 of the IBC.
 - 2. For reference, For reference, utilize AWCI - Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials, Technical Manual 12-A; an annotated guide.
- B. Test and Inspect completed work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Application will be considered defective if it does not pass tests and inspections.
 - 1. Remove and Replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.05 CLEANING

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

SECTION 078400 – FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Firestopping systems
- B Firestopping of all 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 017000 - Closeout Requirements
- B Section 092116 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

- A ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- B ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015.
- C ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b, with Editorial Revision (2016).
- 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; 2013 (Reapproved 2017).
- E ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- F SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- G UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A See Section 013000 - Administrative Requirements, for submittal procedures.
- B Product Data: Provide data on product characteristics, performance ratings, and limitations. Provide for each type of firestopping system product indicated.
- C Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E Certificate from authority having jurisdiction indicating approval of materials used.
- F Installer Qualification: Submit qualification statements for installing mechanics.
- G Shop Drawings: For each firestopping system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestopping design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestopping system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular firestopping condition, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer.

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.
- B Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C Installer Qualifications: Company specializing in performing the work of this section and:
 1. Trained by manufacturer.
 2. Verification of minimum three years documented experience installing work of this type.
 3. An experienced installer who has completed firestopping systems 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.
 4. Licensed by local authorities having jurisdiction (AHJ).
- D Source Limitations: Obtain penetration firestopping systems, for each kind of penetration and construction condition required, from a single manufacturer.
- E Fire-Test-Response Characteristics: Provide firestopping systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 1. Firestopping tests are performed by a qualified for testing and inspecting agency performing testing and follow-up inspection services for firestopping systems acceptable to authorities having jurisdiction.
 2. Penetration firestopping systems: Provide materials that are identical to those tested per ASTM E 814. Provide rated firestopping system products that bear classification marking of qualified testing and inspecting agency.

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. Ventilate firestopping systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.07 PERFORMANCE REQUIREMENTS

- A General: Provide firestopping 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 assembly penetrated.
- B F-Rated Systems: Provide penetration firestopping systems with F-ratings determined per ASTM E 814, equaling or exceeding fire-resistance rating of constructions penetrated.
- C T-Rated Systems: For the following conditions, provide penetration firestopping systems with T-ratings, as well as F-ratings, determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupied floor areas:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.
 - 3. Penetrations located in construction containing fire-protection-rated openings.
 - 4. Penetrating items larger than 4-inch diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- D For penetration firestopping systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.08 COORDINATION

- A Coordinate construction of openings and penetrating items to ensure that firestopping systems are installed according to specified requirements.
- B Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.
- C Notify authorities having jurisdiction at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A Firestopping Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.

2.02 MATERIALS

- A Firestopping Materials: Any materials meeting requirements. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.
- B Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- D Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E Fire Ratings: Refer to drawings for required systems and ratings.
- F Compatibility: Provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.
- G Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestopping systems indicated.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
- B 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.
- C 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.

- D 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.

2.04 FIRESTOPPING SYSTEMS

- A Firestopping: Any material meeting requirements.

2.05 PENETRATION FIRESTOPPING SYSTEMS

- A Description: Classified in Underwriters Laboratories (UL) Fire Resistance Directory, "Section XHEZ - Penetration Firestop Systems", and/or "Section XHHW - Fill Void or Cavity Materials" for specific project conditions.
- B Application Considerations:
 - 1. Firestops exposed to view and/or are scheduled to receive finishes shall be paintable or capable of receiving finish materials.
 - 2. Firestops exposed to traffic, moisture, and physical damage shall be products that do not deteriorate when exposed to these conditions.
 - 3. Firestops for water piping penetrations, of any type, shall be moisture-resistant products.
 - 4. Firestops for floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic shall be products capable of supporting the floor loads involved either by installing floor plates or by other means.
 - 5. Firestops for penetrations involving insulated piping shall be products that do not require removal of insulation.
 - 6. Firestops for cable trays and future penetrations shall be reusable pillows or bags.
- C Provide firestops within fire resistive walls and partitions containing flush mounted devices such as outlet boxes, electrical cabinets and mechanical cabinets mounted back to back and spaced less than 24 inches on center in accordance with UL Fire Resistance Directory "Wall Opening Protective Materials", Category CLIV.
- D For those products requiring mixing before application, comply with penetration firestopping 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 substrate surfaces to receive firestopping systems and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been

corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

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 Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

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 FIELD QUALITY CONTROL

- A Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.
- B Inspection:
 - 1. Owner may employ and pay an independent Inspecting agency to examine firestopping system installations through the course of construction to determine, in general, if it is being installed in compliance with specified requirements. Inspections shall include the following verifications:
 - a. Verify the proper specified firestopping system products and materials are used.
 - b. Verify installer's credentials and certification.
 - c. Verify that each firestopping systems is installed in accordance with product manufacturer's latest published requirements.
 - d. Verify that firestopping system materials and installation comply with appropriate rating authorities' requirements.
 - e. Verify that firestopping system is installed in specified and/or indicated locations in rated assemblies.

3.05 CLEANING

- A Clean adjacent surfaces of firestopping materials.
- B Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which opening and joints occur.

- C Protect firestopping system components during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

3.06 PROTECTION

- A Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 079200 – 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 078413 - Penetration Firestopping
- B Section 088000 - Glazing

1.03 REFERENCE STANDARDS

- A ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.
- B ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012 (Reapproved 2017).
- C ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.
- D ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- E ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.
- F SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

1.04 SUBMITTALS

- A See Section 013000 - 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.
- C Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

1.05 QUALITY ASSURANCE

- A Maintain one copy of each referenced document covering installation requirements on site.

- B Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- D Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- E Field Adhesion Test Procedures:
 - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 - 2. Have a copy of the test method document available during tests.
 - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 - 4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 - 5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
 - 6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- F Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
 - 1. Sample: At least 18 inch (457 mm) long.
 - 2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25 mm) by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
 - 3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
- G Sealant: Sealant must pass the ASTM C719 durability test at the anticipated 'Elongation Capacity' movement when tested on the actual materials to be used in the joint.
- H Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.06 WARRANTY

- A See Section 017000 - Closeout Requirements, for additional warranty requirements.
- B Correct defective work within a five year period after Date of Substantial Completion.
- 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.
- 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.
- C Latex caulk: Subject to compliance with requirements, provide DAP "Alex Plus" acrylic latex caulk plus silicone (paintable) or approved equal.
- D Polyurethane Sealant: Subject to compliance with requirements, provide BASF "Sonolastic NP1", one component elastomeric, gun-grade polyurethane sealant, or approved equal.
- E Silicone: Subject to compliance with requirements, provide GE "Silicone 1" or approved equal.

2.02 JOINT SEALANT APPLICATIONS

- A Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - 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. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.

- B Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS – GENERAL

- A Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B Colors: As indicated on drawings.
- C Exterior Building Joints:
1. Silicone sealant, FS-TT-S-00230C, Type II, non-sag, elongation capability $\pm 50\%$, Class A; color as selected.
 2. Refer to Glazing section 088000 for sealant for exterior glazing.
- D Interior Building Joints: Use non-sag sealants, unless otherwise indicated.
1. Type 1 - Acrylic-Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic for wall and ceiling joints in Non-Wet Areas. Manufacturer: DAP Products, DYNAFLEX 920 Sealant.
 2. Type 2 – 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, non-exposed joints, sill members, flashings, thresholds, splice covers, etc. Manufacturer: Sika Sikalastomer-511 Sealant.
 3. Type 3 - 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. For interior wet areas, use in bathrooms, restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items: Color: White. Manufacturer: Sika Corporation; Sikasil GP.
 4. Type 4 - Non-sag polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for wall and ceiling joints, traffic exposure when recessed below traffic surface. Movement Capability: Plus and minus 35 percent, minimum. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661. Manufacturer: Sika Corporation; Sikaflex-1a.
 5. Type 5 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion. For use at floor Joints in wet areas. Movement Capability: Plus and minus 25 percent, minimum. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661. Color: To

be selected by Architect from manufacturer's standard range. Manufacturer: Sika Corporation, Sikaflex-1c SL.

6. Type 6 – Interior Weather Sealant: Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant. Adheres to wet surfaces. For interior use at perimeter conditions. Color: TBD.
Manufacturer: DAP Products Inc; DYNAFLEX 800 Sealant.
- E Exterior and Interior Building Joints as Indicated: Compressible sealant tape fabricated from an impregnated expanding foam sealant laminated to closed cell foam factory coated two sides with silicone sealant; sized for joint:
 1. Emseal Color-Seal, or approved equal.
- F Glazing Joints - Non-Structural: Silicone sealant, FS-TT-S-00230C, Type II, non-sag, elongation capacity $\pm 50\%$, Class A; clear.
- G Glazing Joints - Structural: Silicone sealant, FS-TT-S-001543A, non-sag, elongation capacity $\pm 25\%$, Class A; capable of autobonding; black, bronze or silver as selected by Architect.
- H Acoustical Sealant: Non-hardening, non-drying, non-bleeding.
- I Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width; non-gassing; non-staining; non-impregnated; compatible with proposed sealant.

2.04 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.
- B Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- D Adhesion Promoters: Blend of organic chemicals, resins and solvents, recommended by sealant manufacturer to suit application.
- E Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application, chemically non-reactive with sealant.
- F Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- G Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- H Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- I Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A Verify that 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 Provide in-field adhesion and substrate testing (following procedures as recommended by manufacturers technical representatives) prior to sealant use to assure optimum performance for joint installation.
- E 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 7 days in advance.
 - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 5. 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.
 - 6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.
- F Inspect the installed work of other trades and verify that surfaces and joint openings are complete, free of spalling or honeycombing, properly sized, properly prepared and ready to accept installation of sealants.
- G Verify that sealant may be installed in accordance with the manufacturer's recommendations.

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.
- F Measure joint dimensions, determine and verify mean anticipated service width of joint, and size materials to achieve required width to depth or compression ratios.
- G Verify compatibility of sealant and substrate, adhesion characteristics and recommended materials. Verify that joint backing and release tapes are compatible with sealants.
- H Protect elements surrounding the work of this Section from damage or disfiguration.

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 Install bond breaker backing tape where backer rod cannot be used.
- E Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F 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.
- G Nonsag Sealants: Tool surface concave as recommended by the manufacturer, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H Mix multi-component sealants in accordance with manufacturer's recommendations.
- I Install compressible sealant tape strips with corners and ends tightly butted and bonded. Tape thickness to provide for a compression of 20% at horizontal joints and 20% to 25% at vertical joints, when joint is at its largest size.

3.04 CLEANING

- A Remove excess material adjacent to the joint by mechanical means or with a solvent, such as xylol or toluol, as recommended by sealant and surface manufacturers. Masking tape shall be removed and surfaces damaged by removal shall be repaired to like-new condition or replaced.

3.05 FIELD QUALITY CONTROL

- A Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- C Rejection of Installed Sealants:
 - 1. Sealants found to be "lifting" or not adhering properly shall be removed, surfaces re-primed and new sealant placed. Application over previously installed sealants will not be acceptable.
 - 2. Sealants which show discoloration, lumpiness, crazing, checking, deterioration, have air pockets or voids along the edges, or which cause staining of substrate will be considered defective and shall be removed, surfaces re-primed and new sealant placed.
 - 3. Sealant installed when in-field testing indicates variance from manufacturer's restrictions or recommendations shall be removed. Re-testing in field shall be performed to identify

necessary change(s) in cleaning, primers, and sealants. Sealant shall be replaced following revised procedure.

3.06 POST-OCCUPANCY

- A Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard and custom hollow metal doors and frames.
 - 2. Steel sidelight, borrowed lite and transom frames.
 - 3. Louvers installed in hollow metal doors.
 - 4. Light frames and glazing installed in hollow metal doors.
- B. Related Sections:
 - 1. Division 01 Section "General Conditions"
 - 2. Division 04 Section "Masonry"
 - 3. Division 06 Section "Rough Carpentry"
 - 4. Division 08 Section "Plastic Laminate-Faced Doors"
 - 5. Division 08 Section "Aluminum-Framed Entrances and Storefronts"
 - 6. Division 08 Section "Glazing"
 - 7. Division 08 Section "Door Hardware"
 - 8. Division 09 Sections "Painting"
 - 9. Division 26 Section "Electrical"
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. SDI-113 Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door & Frame Assemblies.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM C1199 - Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
12. ASTM E1423 - Practice for Determining Steady State Thermal Transmittance of Fenestration Systems.
13. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
14. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
15. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
16. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
17. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
18. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
19. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 1. CECO Door Products (C).
 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
 1. Fabricate frames with mitered or coped corners.
 - a. Knock-down frame construction is not acceptable and shall not be used.
 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 1. Fabricate frames with mitered or coped corners.
 - a. Knock-down frame construction is not acceptable and shall not be used.
 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - CM Series.
 - b. Curries Company (CU) - M Series.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

- A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.
 1. Blade Type: Vision proof inverted V or inverted Y.
 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

- b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
- 10. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

- c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

SECTION 081400 – PLASTIC LAMINATE-FACED WOOD DOORS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Plastic Laminate Wood doors, fire rated and non-rated.

1.02 REFERENCES

- A. ANSI/NWMA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).
- B. ANSI A135.4 - Basic Hardboard.
- C. ASTM E90 - Measurement of Airborne Sound Transmission Loss of Building Partitions.
- D. ASTM A152 - Methods of Fire Tests of Door Assemblies.
- E. AWI - Quality Standards of Architectural Woodwork Institute.
- F. NFPA 80 - Fire Doors and windows.
- G. NFPA 252 - Standard Method of Fire Tests for Door Assemblies.
- H. UL 10B - Fire Tests of Door Assemblies.

1.03 DESCRIPTION OF WORK

- A. Extent and location of each type of door is shown on Drawings and in schedules.
- B. Types of doors required include the following:
 - 1. Solid core flush wood doors with plastic laminate faces.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of AWI Quality Standard Section 1300 Premium Grade. ANSI/NWMA I.S.1.
- B. Fire Door Construction: Conform to ASTM E152, NFPA 252, and UL 10B.
- C. Installed Doors: Conform to NFPA 80 "Standard for Fire Doors and Windows" and which have been tested and rated with single point hardware by UL.
- D. Non-Fire Rated Wood Doors: NWMA Industry Standard I.S.-1 "Wood Flush Doors" of the National Woodwork Manufacturer's Association.
- E. Factory mark each door with NWMA "Quality Certified" Seal of Approval for conformance with NWMA I.S.-1.
- F. Provide UL label on each fire-rated door and panel.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable building codes for fire-rated doors and panels.

1.06 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 013000.
- B. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers. As applicable per drawings.

- C. Specific Product Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or which show photographing of construction below in face veneers, or do not conform to tolerance limitations of NWMA.

The warranty shall also include refinishing and reinstallation which may be required due to repair or replacement of defective doors. Warranty shall be in effect during the following periods of time after date of substantial completion.

1. Solid Core Flush Interior Doors: Five years.
- D. Submit manufacturer's certificate under provisions of Section 014000 that doors and louvers meet or exceed specified fire-rated requirements.
- E. Samples for Verification: Submit samples for each type of exposed finish required.
1. Size of actual composite door sample: 6" x 6" with one finished edge and both sides representing actual facing material to be used.
 2. Finish door facing samples with same material proposed for factory finish.
 3. Light Frames: Corner sample of light frame proposed to be used. Each leg 6" long.
 4. Door Louvers: Louver blade and frame section - 6" square

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect wood doors during transit storage and handling to prevent damage, soiling and deterioration. Comply with the "On-Site Care" recommendations of NWMA pamphlet "Care and Finishing of Wood Doors" and with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 DOOR TYPES

- A. Flush Interior Doors: 1-3/4 inches thick; solid core construction; faces to be 0.05" general purpose HPDL, fire rated as indicated. Color of plastic laminate indicated, per Drawings

2.02 ACCEPTABLE MANUFACTURERS

- A. Marshfield-Algoma by Masonite Architectural.
- B. Eggers
- C. Oshkosh Door Company
- D. VT Industries, Inc.

2.03 DOOR AND PANEL CONSTRUCTION

- A. Product Quality Standard
1. Solid, Non-Rated Core: AWI Section 1300,
 2. Solid, Fire Rated Core: AWI Section 1300, as required, per Drawings
 3. Cross bands: one ply 1/16" hardwood.

2.04 FLUSH DOOR FACING

- A. Facing Quality: AWI premium.

2.05 ADHESIVES

- A. Interior Doors: AWI, ANSI/NWMA, Type II.

2.06 ACCESSORIES

- A. Glass Stops: Rolled metal type designed to conform to UL requirements.
- B. Provide 5" x 12" lock block for exit devices and mortise locks.
- C. Provide solid blocking for door closers.
- D. Provide 5" top and bottom rails.
- E. Lock Blocks: 5 inch by 10 inch - one for lock and two for exit devices.
- F. Provide electric raceway for electric security hardware as specified in Section 087100 Door Hardware. Coordinate with Hardware Supplier.

2.07 FABRICATION

- A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.
- B. Fabricate fire-rated doors in accordance with AWI Quality Standards and to UL requirements. Attach fire rating label to door edge.
- C. Provide flush doors with 1/2 inch thick edge strips of wood species to match face veneer.
- D. Pre-machine doors for finish hardware.
- E. Provide Z- or T- shaped metal astragals in one piece to UL requirements for double fire doors to rating required.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions.
- B. Machine cut relief for hinges and closers and coring for handsets and cylinders.
- C. Trim door width by cutting equally on top and bottom edges to a maximum of 3/16 inch.
- D. Trim door height by cutting equally on top and bottom edges to a maximum of 3/4 inch. Trim fire door height at bottom edge only, to a maximum of one inch.
- E. Pilot drill screw and bolt holes.
- F. Prepare doors to receive finish hardware in accordance with AWI requirements.

3.02 INSTALLATION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.03 ADJUSTING AND CLEANING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 083485 - FIRE RATED AUTOMATIC SMOKE CURTAINS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Fire protective smoke containment curtain system designed to provide a tight-fitting, smoke- and draft-control assembly as well as fire protection.
- B. Products Supplied But Not Installed Under This Section:
 - 1. Group Control Panel unit.
 - 2. Emergency Up Buttons
- C. Related Sections:
 - 1. 092116 – Gypsum Board Assemblies
 - 2. 099000 – Paints and Coatings
 - 3. 283111 – Digital Addressable Fire Alarm
 - 4. Division 26 - 120VAC and control circuit power including conduit, boxes, conductors, wiring devices, and emergency power.
 - 5. 08 3100 Access Panels

1.02 REFERENCES

- A. ASTM E84-10 test report with calculated smoke development (CSD) of 2 and a smoke developed index (SDI) of 0 and a calculated flame spread (CFS) of 0.
- B. ICC Evaluation Service ESR-Report – Legend Report showing compliance with opening force, cyclic force, expansion characteristics
- C. NFPA Codes and Standards:
 - 1. 70 – National Electrical Code.
 - 2. 105 – Recommended Practice for the Installation of Smoke-Control Door Assemblies.
 - 3. ASTM – E84 Test report with Calculated Smoke Developed (CSD) of 2 and a Smoke Developed Index (SDI) of 0 and a Calculated Flame Spread (CFS) of 0.
- D. UL Minimum Performance Standards
 - 1. UL 10B Fire test for door assemblies
 - 2. UL10C Positive pressure fire test for door assemblies
 - 3. UL 10D Fire test for protective curtains
 - 4. UL Oversized Certificate
 - 5. UL 864 – Classified Control Units for Fire Protective Signaling Systems.
 - 6. UL 1784 – Air Leakage Tests for Door Assemblies.
 - 7. Impact test required by independent testing laboratory
 - 8. Gravity fail-safe design. No battery back-up will be required for deployment

9. Certified to ISO 9001 1994 for the design, manufacturing, installation, and commissioning of Automatic Smoke Barriers and Partitions.
10. UL follow up service report required

E. OSHPD Anchorage Pre-Approved OPM-0554-19

1.03 SUBMITTALS

- A. Product Data: For each type of product
 1. Shop Drawings: Show fabrication and installation details for automatic smoke curtains. Include plans, sections details, attachments to other work and the following:
 - a. Operating clearances
 - b. Requirements for supporting automatic smoke curtains, track, equipment.
 - c. Locations of equipment components, switches, motors and controls. Differentiate between manufacturer-installed and field installed wiring
 2. Quality Assurance/Control Submittals:
 - a. Certifications: Copy of specified items.
 - b. Manufacturer's installation instructions and testing procedures

1.04 CLOSEOUT SUBMITTALS

- A. Comply Section 017000 – Closeout Requirements; submit following items:
 1. Operation and Maintenance Manual
 2. Manufacturer's Warranties

1.05 QUALITY ASSURANCE

- A. Overall Standards:
 1. Manufacturer shall maintain a quality control program in accordance with ICC-ES Acceptance Criteria.
 2. UL follow up Service Report
 3. Product must bear a UL label. "Tested in accordance to" standard not acceptable for fire rated smoke curtains. Intertek label not acceptable.
- B. Qualifications:
 1. Manufacturer Qualifications: Minimum five years experience in producing smoke containment systems of the type specified.
 2. Installer Qualifications: Factory trained by manufacturer.
- C. Certifications:
 1. Impact test report by independent laboratory
 2. UL 10B Fire test of door assemblies time temperature curve (no hose stream)
 3. UL 10C Positive Pressure fire test for door assemblies time temperature curve (no hose stream)
 4. UL Testing Laboratory Label.

5. UL 1784 UL Labeled, listed, classified, certified and marked Smoke & Draft assembly with no more than an air leakage of 3.CFM
 6. UL 864 UL Labeled, listed, classified, certified and marked control units and accessories for Fire Alarm Systems
 7. UL Oversized certificate labeled, listed, classified, certified and marked
 8. UL-10D Three Hour Fire Protective Curtain Listing Label.
 9. OSHPD Anchorage Pre-Approval OPM-0554-19
- D. Pre-Installation Meeting:
1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Architect, General Contractor, smoke containment system sub-contractor, painting sub-contractor, and electrical sub-contractor.
 2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
 3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 016000 – Product Requirements.
- B. Follow manufacturer's instructions.

1.07 WARRANTY

- A. Provide manufacturer's standard one-year warranty.
- B. Maintenance and Testing:
 1. Perform minimum annual maintenance and testing on each smoke and fire containment system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
 2. Provide test documentation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Model DSI-C3HR Smoke and Fire Curtain
- B. Manufacturer: DSI Smoke and Fire Curtains
www.doorsysinc.com 866-534-3667
- C. Label each smoke containment system with following information:
 1. Manufacturer's name.
 2. Maximum leakage rating at specified pressure and temperature conditions.
 3. Label of quality control agency.

2.02 PERFORMANCE REQUIREMENTS

- A. Air Leakage: Not to exceed 3 cfm (0.001416 m³/s) per sf of door opening.
- B. Fire Rating: UL-10D Three hour fire rated and labeled.

2.03 COMPONENTS

- A. The curtain head box shall be manufactured from 1.2mm galvanized steel. The enclosure shall be rated at the same temperature as the curtain fabric.
- B. Removable cover plates shall be incorporated to allow access to the curtain rollers.
- C. Standard head box sizes shall be 7 ½" x 7 ½" for single rollers (maximum width 16'-0") and 12 ¼" x 8 ¼" for multiple rollers (over 16'-0" wide). Larger head boxes may be required where the curtain drop is in excess of 9'-10".
- D. Side guide rails shall be 2" deep x 4" wide, primed steel finish
- E. A weighted bottom bar shall be provided to prevent deflection and ensure correct operation under gravity.
- F. The roller shall be constructed from an octagonal tube which will incorporate a 24v D.C. motor and gearbox and a sealed heavy-duty ball bearing assembly.
- G. A motor control circuit housed in a steel enclosure shall be mounted onto the motor end of the head box.
- H. Provide each motorized curtain with back Electromagnetic force-controlled speed of descent of no less than 6 inches per second and no more than 24 inches per second.
- I. The fabric curtain shall be manufactured from VWG690 woven glass cloth. The woven glass fiber fabric shall have a nominal weight of no less than 690g/square meter and shall be UL listed for three hours.

2.04 OPERATION

- A. The smoke and fire curtain shall deploy upon a signal from the fire alarm system in an emergency situation.
- B. The system must be proven to "fail safe" to the operational position on total loss of primary and auxiliary power. The system must contain a housed battery system at the Group Control Panels.
- C. Under normal operating conditions the curtains would be held in the retracted position via the motors operating at low voltage. The manufacture must be able to confirm that the motor windings are suitable for this type of operation.
- D. Upon activation of the fire alarm the control panel will remove the supply voltage and the curtain shall descend under the power of gravity in a controlled manner. A dynamic braking system housed in the motor control circuit shall control the speed of the descent of the curtain. The descent shall be electronically synchronized on overlapping curtains with a bottom bar.

- E. To retract the curtain the control panel shall supply 24v to the motor control circuits and motors will drive the curtains to the upper position. As the bottom bar or stopping bar hits the curtain head box a current limiting circuit will step back the voltage and current and hold the bottom bar in the retracted position.
- F. Limit switches are not to be used to control the upper position of the curtain.
- G. An optional braking system is available at the manufacture stage to allow a two-stage descent during gravity deployment. Should the main power fail to the group control panel, the supply is automatically switched to the integral standby battery. The curtain remains in the retracted position for 1 hour (fully retracted loaded system). The curtain will remain fully operational until the battery low voltage cut off facility reads a voltage of 21v; the curtains will then safely descend under the power of gravity to the operational position.
- H. Group Control Panel: Provide Group Control Panel (GCP) capable of controlling up to 5 no. 24v motor assemblies. During normal operation, the GCP will provide a 24v AC supply to the curtain motor holding them in the retracted position. Should smoke be detected, the fire alarm contact in the GCP will be opened by the fire alarm control system, the GCP will remove the 24v supply to the curtain motors and the curtains will descend under the power of gravity in a controlled manner.
- I. Open on fire- configured to be gravity fail safe
- J. Test Facility- key switch required
- K. All push to exit buttons must contain internal battery back-up power supply for fail safe operation for ICC ES requirements.
- L. Weight of bottom to be 1.5 pounds per linear foot for curtain to for secondary means of egress for compliance with ICC ES requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates upon which work will be installed.
 - 1. Verify related work performed under other sections is complete and in accordance with Shop Drawings.
 - 2. Verify wall surfaces and elevator door frames are acceptable for installation of smoke containment system components.

3.02 INSTALLATION

- A. Install smoke containment system components in accordance with manufacturer's installation instructions.

3.03 FIELD QUALITY CONTROL

- A. Field Test: Follow manufacturer's cycle test procedures.

1. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor a minimum one week in advance of scheduled testing.
2. Complete maintenance service record.

3.04 DEMONSTRATION

- A. Demonstrate required testing and maintenance procedures to Owner's Representative.
- B. Maintenance and Testing:
 1. Perform minimum annual maintenance and testing on each smoke and fire curtain system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
 2. Retain permanent record of tests.
- C. Qualified Door Systems, Inc Inspector assesses unit(s) after exposure to a fire event.

3.05 MAINTENANCE

- A. Engage a Door Systems authorized service representative to test, adjust and maintain the system once per annum as required per NFPA 101 and NFPA 80.

END OF SECTION

SECTION 083490 - HOSE STREAM RATED SMOKE AND FIRE CURTAIN

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Fire and smoke rated fabric curtain system designed to provide a tight-fitting, smoke- and draft-control assembly as well as fire protection.
- B. Products Supplied but Not Installed Under This Section:
 - 1. Group Control Panel unit.
 - 2. Battery backup system
- C. Related Sections:
 - 1. 092116 - Gypsum Board Assemblies
 - 2. 099000 - Paints and Coatings
 - 3. 283111 - Digital Addressable Fire Alarm
 - 4. Division 26 - 120VAC and 24V control circuit power including conduit, boxes, conductors, wiring devices, and emergency power.

1.02 REFERENCES

- A. ASTM E84-10 test report with calculated smoke development (CSD) of 2 and a smoke developed index (SDI) of 0 and a calculated flame spread (CFS) of 0.
- B. NFPA Codes and Standards:
 - 1. 70 - National Electrical Code.
 - 2. 105 - Recommended Practice for the Installation of Smoke-Control Door Assemblies.
 - 3. ASTM – E84 Test report with Calculated Smoke Developed (CSD) of 2 and a Smoke Developed Index (SDI) of 0 and a Calculated Flame Spread (CFS) of 0.
- C. UL Minimum Performance Standards
 - 1. UL 10B Fire test for door assemblies with hose stream test
 - 2. UL Oversized Certificate where units exceed the testing laboratory's label size
 - 3. UL 1784 - Air Leakage Tests for Door Assemblies.
 - 4. Gravity fail-safe design. No battery back-up will be required for deployment
 - 5. Certified to ISO 9001 1994 for the design, manufacturing, installation, and commissioning of Automatic Smoke Barriers and Partitions.
 - 6. Accredited testing lab follow up service report required.

1.03 SUBMITTALS

- A. Product Data: For each type of product
 - 1. Shop Drawings: Show fabrication and installation details for automatic smoke curtains. Include plans, sections details, attachments to other work and the following:
 - a. Operating clearances

- b. Requirements for supporting automatic smoke curtains, track, equipment.
- c. Locations of equipment components, switches, motors and controls. Differentiate between manufacturer-installed and field installed wiring.
- 2. Quality Assurance/Control Submittals:
 - a. Certifications: Copy of specified items.
 - b. Manufacturer's installation instructions and testing procedures

1.04 CLOSEOUT SUBMITTALS

- A. Comply Section 017000 - Closeout Requirements; submit following items:
 - 1. Operation and Maintenance Manual
 - 2. Manufacturer's Warranties

1.05 QUALITY ASSURANCE

- A. Overall Standards:
 - 1. Provide units tested, approved, and labeled under UL 10B with Hose Stream and UL 1784 standards
 - 2. Accredited testing laboratory follow-up Service Report
 - 3. Testing laboratory's label permanently affixed to bottom bar
- B. Qualifications:
 - 1. Manufacturer Qualifications: Minimum five years' experience in producing smoke curtain systems.
 - 2. Installer Qualifications: Factory trained by manufacturer.
- C. Certification:
 - 1. UL accredited Testing Laboratory Label for UL 10B 180-minute fire test of door assemblies with hose stream
 - 2. UL 1784 Label
 - 3. Oversized certificate labeled, listed, classified, certified, and marked where units exceed testing laboratory's label size
- D. Pre-Installation Meeting:
 - 1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Architect, General Contractor, smoke containment system sub-contractor, painting sub-contractor, and electrical sub-contractor.
 - 2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
 - 3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section 016000 - Product Requirements.
- B. Follow manufacturer's instructions.

1.07 WARRANTY

- A. Provide manufacturer's standard one-year warranty.
- B. Maintenance and Testing:
 - 1. Perform minimum annual maintenance and testing on each smoke and fire containment system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
 - 2. Provide test documentation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Model DSI-HS10B Hose Stream Rated Smoke and Fire Curtain
- B. Manufacturer: DSI Smoke and Fire Curtains
www.doorsysinc.com 866-534-667
- C. Label each smoke containment system with following information:
 - 1. Manufacturer's name.
 - 2. Maximum leakage rating at specified pressure and temperature conditions.
 - 3. Label of quality control agency.

2.02 PERFORMANCE REQUIREMENTS

- A. Air Leakage: Not to exceed 3 cfm (0.001416 m³/s) per sf of door opening.
- B. Fire Rating: UL-10B 180-minute fire rated and labeled.

2.03 COMPONENTS

- A. The curtain head box shall be manufactured from 1.2mm galvanized steel. The enclosure shall be rated at the same temperature as the curtain fabric.
- B. Removable cover plates shall be incorporated to allow access to the curtain rollers.
- C. Standard head box sizes shall be 9" x 9" for single rollers (maximum width 16'-0") and 15" x 9" for multiple rollers (over 16'-0" wide). Larger head boxes may be required where the curtain drop is in excess of 10'-0".
- D. Side guide rails shall be 2" deep x 4" wide, primed steel finish.
- E. A weighted bottom bar shall be provided to prevent deflection and ensure correct operation under gravity.
- F. The roller shall be constructed from an octagonal tube which will incorporate a 24v D.C. motor and gearbox and a sealed heavy-duty ball bearing assembly.
- G. A motor control circuit housed in a steel enclosure shall be mounted onto the motor end of the head box.

- H. Provide each motorized curtain with back Electromagnetic force-controlled speed of descent of no less than 6 inches per second and no more than 24 inches per second.
- I. The fabric curtain shall be manufactured from multiple layers of woven glass cloth and wired mesh.

2.04 OPERATION

- A. The smoke and fire curtain shall deploy upon a signal from the fire alarm system in an emergency situation.
- B. The system must be proven to "fail safe" to the operational position on total loss of primary and auxiliary power.
- C. Under normal operating conditions the curtains would be held in the retracted position via the motors operating at low voltage. The manufacture must be able to confirm that the motor windings are suitable for this type of operation.
- D. Upon activation of the fire alarm the control panel will remove the supply voltage and the curtain shall descend under the power of gravity in a controlled manner. A dynamic braking system housed in the motor control circuit shall control the speed of the descent of the curtain. The descent shall be electronically synchronized on overlapping curtains with a bottom bar.
- E. To retract the curtain the control panel shall supply 24v to the motor control circuits and motors will drive the curtains to the upper position. As the bottom bar or stopping bar hits the curtain head box a current limiting circuit will step back the voltage and current and hold the bottom bar in the retracted position.
- F. Limit switches are not to be used to control the upper position of the curtain.
- G. Should the main power fail to the group control panel, the supply is automatically switched to the integral standby battery. The curtain remains in the retracted position for 1 hour (fully retracted loaded system). The curtain will remain fully operational until the battery low voltage cutoff facility reads a voltage of 21v; the curtains will then safely descend under the power of gravity to the operational position.
- H. Group Control Panel: Provide Group Control Panel (GCP) capable of controlling up to 3 no. 24v motor assemblies. During normal operation, the GCP will provide a 24v AC supply to the curtain motor holding them in the retracted position. Should smoke be detected, the fire alarm contact in the GCP will be opened by the fire alarm control system, the GCP will remove the 24v supply to the curtain motors and the curtains will descend under the power of gravity in a controlled manner.
- I. Open on fire- configured to be gravity fail safe
- J. Test Facility switch required

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates upon which work will be installed.
 - 1. Verify related work performed under other sections is complete and in accordance with Shop Drawings.
 - 2. Verify wall surfaces are acceptable for installation of smoke containment system components.

3.02 INSTALLATION

- A. Install smoke containment system components in accordance with manufacturer's installation instructions.

3.03 FIELD QUALITY CONTROL

- A. Field Test: Follow manufacturer's cycle test procedures.
 - 1. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor a minimum one week in advance of scheduled testing.
 - 2. Complete maintenance service record.

3.04 DEMONSTRATION

- A. Demonstrate required testing and maintenance procedures to Owner's Representative.
- B. Maintenance and Testing:
 - 1. Perform minimum annual maintenance and testing on each smoke and fire curtain system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
 - 2. Retain permanent record of tests.
- C. Qualified Door Systems, Inc Inspector assesses unit(s) after exposure to a fire event.

3.05 MAINTENANCE

- A. Engage a Door Systems authorized service representative to test, adjust and maintain the system once per annum as required per NFPA 101 and NFPA 80.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. 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 01 Section "General Conditions".
 - 2. Division 06 Section "Rough Carpentry".
 - 3. Division 06 Section "Finish Carpentry".
 - 4. Division 08 Section "Operations and Maintenance".
 - 5. Division 08 Section "Hollow Metal Doors and Frames".
 - 6. Division 08 Section "Flush Wood Doors".
 - 7. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 8. Division 26 Section "Electrical".
- D. Codes and References: Comply with the version 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 as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.

2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. 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.

1.4 CLOSEOUT SUBMITTALS

- A. 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.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 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. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. 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.

- D. 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.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 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".

1.7 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.

1.8 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. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

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 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.3 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 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: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
- 5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.4 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-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. Pemko (PE).

2.5 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges 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 with a 1-year warranty. 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. McKinney (MK) - QC (# wires) Option.
- B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with 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 (PE) - SER-QC (# wires) Option.

- C. 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 (MK) - Electrical Connecting Kit: QC-R001.

b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:
 - a. Rockwood (RO).

- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units 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. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:
 - a. Rockwood (RO).

2.7 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.
 1. Manufacturers:
 - a. Match Existing, Field Verify.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. 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.
 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. 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).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. 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.

2.8 KEY CONTROL

- A. 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).

2.9 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Electromechanical locksets shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
 - d. Two-year limited warranty on electrified functions.
 - 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.

2.10 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.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. 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.
3. 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.
4. 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.
5. 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.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide exit devices with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. Five-year limited warranty for mechanical features.
 2. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
 3. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7000 Series.
- C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs. certified independent tested.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7050 Series.
- D. Conventional Push Rail Exit Devices, Aluminum Entrances: ANSI/BHMA A156.3, Grade 1 panic devices furnished in the functions specified in the Hardware Sets. Push bar to be made of extruded aluminum, maximum projection of 3", available in clad or anodized architectural finishes. Exit device design to fit narrow (minimum 2"), medium, or wide stile aluminum door applications.
 1. Manufacturers:
 - a. Adams Rite Manufacturing (AD) - 8000 Series.
- E. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.
 1. Provide mullions with functions and features as follows:
 - a. Provide keyed removable feature where specified in the Hardware Sets.
 - b. Provide stabilizers and mounting brackets as required.
 2. Manufacturers:
 - a. Same as exit device manufacturer.

2.12 SURFACE 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.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
 - 1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 - 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
 - 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
- D. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency 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 of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.
 - 1. Manufacturers:
 - a. Corbin Russwin (RU) - DC5000 Series.
 - b. Norton Rixson (NO) - 2800ST Series.
 - c. Sargent Manufacturing (SA) - 422 Series.

2.13 ARCHITECTURAL TRIM AND ACCESSORIES

- A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1" less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Provide protective trim with functions and features as follows:
 - a. Meets ADA requirements for smooth bottom door surfaces.
 - b. UL Classified options for use on fire-rated doors up to 3 hours.
 - c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.

- d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
- e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
- f. Fasteners included; adhesive-backed options available for select models.
- g. Ten-year limited warranty.
- 2. Manufacturers:
 - a. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

- A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Rockwood (RO).
- B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed 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. Norton Rixson (NO).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 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 (PE).

2.16 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Alarm Controls (AK) - CP1-1026 Series.
 - b. Securitron (SU) - DPS Series.
- B. Linear Power Supplies: Filtered and regulated power for electrified hardware. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Provide power supplies with functions and features as follows:
 - a. 120VAC input with selectable output at 12VDC (6 amp) or 24VDC (3 amp).
 - b. Internal back-up battery (batteries not included) charging circuit.
 - c. Regulated and filtered, fuse protected outputs.
 - d. Each output can be individually turned on and off via a jumper.
 - e. Power status of each output is shown by an LED.
 - f. Fire alarm interface; dry contacts NO/NC, 9-33VDC, 3-15mA.
 - 2. Manufacturers:
 - a. Sargent (SA) - LSP Series.
- C. Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.
 - a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
 - b. Tolerates brownout or overvoltage input $\pm 15\%$ of nominal voltage.
 - c. Thermal shutdown protection with auto restart.
 - d. Circuit breaker protection against overcurrent and reverse battery faults.
 - e. Integrated battery charging circuit to prevent overvoltage on locking devices.
 - f. Available with a single relay fire trigger or individually triggered relayed outputs.
 - g. Monitoring options as specified.
2. Manufacturers:
 - a. Securitron (SU) - AQD Series.

2.17 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 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. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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.
 1. Quantities listed are for each pair of doors, or for each single door.
 2. The supplier is responsible for handing and sizing all products.
 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
- B. Manufacturer's Abbreviations:
 1. MK - McKinney
 2. OT - Other

- 3. PE - Pemko
- 4. RO - Rockwood
- 5. YA - ASSA ABLOY ACCENTRA
- 6. AD - Adams Rite
- 7. NO - Norton Rixson
- 8. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 1.0101A, 1.0101B

Description: EXTERIOR - ALUM - AUTOMATIC SLIDING

2 Cylinder	As Required to Match Existing Key System

Notes:

- Balance of hardware furnished by the automatic sliding door manufacturer.
- Automatic sliding door supplier to verify cylinder type, quantity & finish required - IF ANY.
- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Provide blocking/spacer rings in thickness as required to fill gap, if any, between cylinder head and face of door.

Set: 2.0

Doors: H.1.0101

Description: EXTERIOR - ALUM - PAIR - FIRE RATED - AUTO ACTUATOR

8 Hinges/Hanging	Per Fire Rated Alum Storefront Door and Frame Assembly Manufacturer Requirement/Recommendation	OT

2 Power Transfer	Per Fire Rated Alum Storefront	
	Door and Frame Assembly	OT ⚡
	Manufacturer	
2 Fire Rated Panic Hardware w/ Electric Latch Retraction	Requirement/Recommendation	
	Per Fire Rated Alum Storefront	
	Door and Frame Assembly	OT ⚡
1 Cylinder	Manufacturer	
	Requirement/Recommendation	
	As Required to Match Existing Key System	
2 Auto Operator	Per Automatic Operator Section	OT ⚡
2 Actuator	By Auto Operator Provider	OT ⚡
1 Perimeter Gasket/Seal/Threshold	Per Fire Rated Alum Storefront	
	Door and Frame Assembly	OT
	Manufacturer	
1 Power Supply	Requirement/Recommendation	
1 Wiring/Point-to-Point Diagram	AQD Series	SU ⚡
1 Elevation Diagram		
1 Riser Diagram		

Notes:

- Fire rated alum storefront door and frame supplier to verify cylinder type, quantity & finish required - IF ANY.
- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Provide blocking/spacer rings in thickness as required to fill gap, if any, between cylinder head and face of door.
- Delete power supply if a power supply that can provide power for the exit devices is integrated into the automatic operator.
- Coordinate with electrical contractor.

Operational Narrative:

1. Doors are normally closed.
2. Assisted ingress/egress by actuator retracts the exit device latches and cycles auto operators.
3. Egress free for immediate exit.

Set: 3.0

Doors: 1.0122

Description: EXTERIOR - ALUM - PAIR - PANIC DEVICE - CLOSER - BADGE ACCESS

2 Continuous Hinge	CFM__SLF-HD1 SER__ x Length Required		PE	⚡
2 Concealed Vert Rod Exit	8600 MLR M MEC-US32D ELX	US32D	AD	⚡
1 Cylinder Escutcheon	8650	US32D	AD	
1 Cylinder	As Required to Match Existing Key System			
2 Door Pull	BF159 Mtg-Type 12HD	US32D	RO	
2 Surface Closer	UNIJ4400	689	YA	
2 Frame Wire Harness	QC-C1500P		MK	⚡
2 Door Wire Harness	QC-C*** (length / type as required)		MK	⚡
2 Position Switch	DPS-M/W-BK (as required per application)		SU	⚡
1 Card Reader	Provided By Security Supplier		OT	⚡
1 Power Supply	PS-EXIT		AD	⚡
1 Wiring/Point-to-Point Diagram				
1 Elevation Diagram				
1 Riser Diagram				

Notes:

- Balance of hardware: Threshold, door sweeps, perimeter and meeting stile gasket furnished by the aluminum storefront door and frame manufacturer.
- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.

- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of door closers.
- Verify finish of hardware.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Doors are normally closed and secured.
2. Authorized access by card reader retracting exit device latches for predetermined time limit.
3. Egress free for immediate exit.
4. REX switch in push rails allow authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 4.0

Doors: 1.0108A

Description: EXTERIOR - ALUM - PAIR - PANIC DEVICE - BADGE ACCESS & AUTO ACTUATOR

2 Continuous Hinge	CFM__SLF-HD1 SER__ x Length Required		PE	⚡
2 Concealed Vert Rod Exit	8600 MLR M MEC-US32D ELX	US32D	AD	⚡
1 Cylinder Escutcheon	8650	US32D	AD	
1 Cylinder	As Required to Match Existing Key System			
2 Door Pull	BF159 Mtg-Type 12HD	US32D	RO	
2 Auto Operator	Per Automatic Operator Section		OT	⚡
1 Actuator	By Auto Operator Provider		OT	⚡
2 Frame Wire Harness	QC-C1500P		MK	⚡
2 Door Wire Harness	QC-C*** (length / type as required)		MK	⚡

2 Position Switch	DPS-M/W-BK (as required per application)	SU ⚡
1 Card Reader	Provided By Security Supplier	OT ⚡
1 Power Supply	PS-EXIT	AD ⚡
1 Wiring/Point-to-Point Diagram		
1 Elevation Diagram		
1 Riser Diagram		

Notes:

- Balance of hardware: Threshold, door sweeps, perimeter and meeting stile gasket furnished by the aluminum storefront door and frame manufacturer.
- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Provide all required drop plates and filler plates to ensure proper installation of auto operators.
- Verify finish of hardware.
- Delete power supply if a power supply that can provide power for the exit devices is integrated into the automatic operator.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Doors are normally closed and secured.
2. Authorized access by card reader retracts the exit device latches and cycles auto operators.
3. Assisted egress by actuator retracts the exit device latches and cycles auto operators.
4. Egress free for immediate exit.
5. REX switch in push rails allow authorized exit without alarm condition.
6. Door position switches monitor open/closed status.
7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 5.0

Doors: 1.0124, 1.0125, 1.0126, 1.0127

Description: EXTERIOR - ALUM - PANIC DEVICE - CLOSER - BADGE ACCESS

1 Continuous Hinge	CFM__SLF-HD1 SER__ x Length Required		PE	⚡
1 Rim Exit Device	P8800 MLR M MEC-US32D ELX	US32D	AD	⚡
1 Cylinder	As Required to Match Existing Key System			
1 Door Pull	BF159 Mtg-Type 12HD	US32D	RO	
1 Surface Closer	UNIJ4400	689	YA	
1 Frame Wire Harness	QC-C1500P		MK	⚡
1 Door Wire Harness	QC-C*** (length / type as required)		MK	⚡
1 Position Switch	DPS-M/W-BK (as required per application)		SU	⚡
1 Card Reader	Provided By Security Supplier		OT	⚡
1 Power Supply	PS-EXIT		AD	⚡
1 Wiring/Point-to-Point Diagram				
1 Elevation Diagram				
1 Riser Diagram				

Notes:

- Balance of hardware: Threshold, door sweep and perimeter gasket furnished by the aluminum storefront door and frame manufacturer.
- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of door closer.
- Verify finish of hardware.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Door is normally closed and secured.
2. Authorized access by card reader retracting exit device latch for predetermined time limit.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 6.0

Doors: 1.0121, 1.0123

Description: EXTERIOR - ALUM - PANIC DEVICE - CLOSER

1 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE
1 Rim Exit Device	P8800 MEC-US32D	US32D	AD
1 Exit Device Trim, Nightlatch	3080 01-Curve 3 7	US32D	AD
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	UNIJ4400	689	YA

Notes:

- Balance of hardware: Threshold, door sweep and perimeter gasket furnished by the aluminum storefront door and frame manufacturer.
- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of door closer.
- Verify finish of hardware.

Set: 7.0

Doors: 1.0103C

Description: EXTERIOR - ALUM - PANIC DEVICE - CLOSER

1 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE

1 Rim Exit Device	P8800 MEC-US32D	US32D	AD
1 Cylinder	As Required to Match Existing Key System		
1 Door Pull	BF159 Mtg-Type 12HD	US32D	RO
1 Surface Closer	UNIJ4400	689	YA
1 Position Switch	DPS-M/W-BK (as required per application)		SU ⚡

Notes:

- Balance of hardware: Threshold, door sweep and perimeter gasket furnished by the aluminum storefront door and frame manufacturer.
- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of door closer.
- Exit device can be dogged down for push / pull operation.
- Verify finish of hardware.
- Door position switch monitors open/closed status.

Set: 8.0

Doors: ST-1.2A

Description: EXTERIOR - ALUM - PAIR - PANIC DEVICE - CLOSER

2 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE
2 Concealed Vert Rod Exit	8600 MEC-US32D	US32D	AD
2 Surface Closer	UNIJ4400	689	YA
2 Position Switch	DPS-M/W-BK (as required per application)		SU ⚡

Notes:

- Balance of hardware: Threshold, door sweeps, perimeter and meeting stile gasket furnished by the aluminum storefront door and frame manufacturer.
- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.

- Provide all required drop plates and filler plates to ensure proper installation of door closers.
- Verify finish of hardware.
- Door position switches monitor open/closed status.

Set: 9.0Doors: [ST-1.1A](#)

Description: EXTERIOR - PAIR - PANIC DEVICE - CLOSER

2 Continuous Hinge	CFM__HD1 x Length Required		PE
1 Key Removable Mullion	KRM200F x Length Required	600	YA
2 Fire Rated Rim Exit, Exit Only	7150F EO	630	YA
1 Cylinder Kit	AMCK1	630	YA
2 Surface Closer	UNI4400	689	YA
2 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Rain Guard	346C x Frame Width		PE
2 Gasketing	303CSTST (head & jambs)		PE
1 Mullion Gasketing	5110BL x Opening Height		PE
2 Sweep	315CN x Door Width		PE
1 Threshold	2005AT x L.A.R. x MSES25SS		PE
2 Position Switch	DPS-M/W-BK (as required per application)		SU ⚡

Notes:

- Door position switches monitor open/closed status.

Set: 10.0

Doors: 1.0101C, 1.0101D

Description: ALUM - AUTOMATIC SLIDING

All Hardware by Aluminum
Sliding Door Manufacturer.

OT

Set: 11.0

Doors: 1.0108C

Description: ALUM - PAIR - PANIC DEVICE - AUTO ACTUATOR

2 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE
2 Concealed Vert Rod Exit	8600T MEC-US32D	US32D	AD
1 Cylinder Escutcheon	8650	US32D	AD
1 Cylinder	As Required to Match Existing Key System		
2 Door Pull	BF159 Mtg-Type 12HD	US32D	RO
2 Auto Operator	Per Automatic Operator Section		OT ⚡
2 Actuator	By Auto Operator Provider		OT ⚡
2 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
1 Perimeter Gasket/Seal	By Aluminum Storefront Door and Frame Manufacturer		OT

Notes:

- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of auto operators.
- Exit devices must be dogged down for push / pull operation in order for auto operators to operate.
- Verify finish of hardware.

Operational Narrative:

1. Doors are normally closed.
2. Assisted ingress/egress by actuator cycles auto operator.
3. Egress free for immediate exit.

Set: 12.0

Doors: 1.3000A, 1.4000, 1.5000, 2.0100B, 2.3100A, 3.0100B

Description: ALUM - PAIR - PANIC DEVICE - CLASSROOM FUNCTION - CLOSER

2 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE
2 Concealed Vert Rod Exit	8600T MEC-US32D	US32D	AD
2 Exit Device Trim, Classroom	3080 01-Curve 3 6	US32D	AD
2 Cylinder	As Required to Match Existing Key System		
2 Surface Closer	4400	689	YA
2 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO	
1 Perimeter Gasket/Seal	By Aluminum Storefront Door and Frame Manufacturer		OT

Notes:

- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of door closers.
- Where possible install closers on doors for optimum aesthetics.
- Exit devices can be dogged down for push / pull operation.
- Verify finish of hardware.

Set: 13.0

Doors: 1.1000

Description: ALUM - PANIC DEVICE - CLASSROOM FUNCTION - CLOSER

1 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE
1 Rim Exit Device	P8800 MEC-US32D	US32D	AD
1 Exit Device Trim, Classroom	3080 01-Curve 3 7	US32D	AD
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO	

1 Perimeter Gasket/Seal	By Aluminum Storefront Door and Frame Manufacturer	OT

Notes:

- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of door closer.
- Where possible install closers on door for optimum aesthetics.
- Exit device can be dogged down for push / pull operation.
- Verify finish of hardware.

Set: 14.0

Doors: 1.2000

Description: ALUM - PANIC DEVICE - CLASSROOM FUNCTION - AUTO ACTUATOR

1 Continuous Hinge	CFM__SLF-HD1 x Length Required		PE
1 Rim Exit Device	P8800 MEC-US32D	US32D	AD
1 Exit Device Trim, Classroom	3080 01-Curve 3 7	US32D	AD
1 Cylinder	As Required to Match Existing Key System		
1 Auto Operator	Per Automatic Operator Section		OT ⚡
2 Actuator	By Auto Operator Provider		OT ⚡
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO	
1 Perimeter Gasket/Seal	By Aluminum Storefront Door and Frame Manufacturer		OT

Notes:

- Coordinate all hardware with the aluminum storefront door and frame manufacturer/supplier.
- Provide all necessary collars or rings, cams, and tailpieces or spindles for each cylinder.
- Provide all required drop plates and filler plates to ensure proper installation of auto operator.
- Exit device must be dogged down for push / pull operation in order for auto operator to operate.

-Verify finish of hardware.

Operational Narrative:

1. Door is normally closed.
2. Assisted ingress/egress by actuator cycles auto operator.
3. Egress free for immediate exit.

Set: 15.0

Doors: **1.0108B**

Description: PAIR - PANIC DEVICE - BADGE ACCESS & AUTO ACTUATOR

2 Continuous Hinge	CFM__HD1 SER__ x Length Required		PE	⚡
1 Fire Rated Surf Vert Rod, Storeroom	7170F90 LBR B MELR AU626F	630	YA	⚡
1 Fire Rated Surf Vert Rod, Dummy	7170F90 LBR B MELR AU629F	630	YA	⚡
1 Cylinder	As Required to Match Existing Key System			
2 Auto Operator	Per Automatic Operator Section		OT	⚡
1 Actuator	By Auto Operator Provider		OT	⚡
2 Armor Plate	K1050 F 36" high CSK BEV	US32D	RO	
2 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO	
2 Astragal	18061CNB x Door Height		PE	
1 Gasketing	S88BL (head & jambs)		PE	
2 Frame Wire Harness	QC-C1500P		MK	⚡
2 Door Wire Harness	QC-C*** (length / type as required)		MK	⚡
2 Position Switch	DPS-M/W-BK (as required per application)		SU	⚡
1 Card Reader	Provided By Security Supplier		OT	⚡

1 Power Supply	AQD Series	SU	⚡
1 Wiring/Point-to-Point Diagram			
1 Elevation Diagram			
1 Riser Diagram			

Notes:

- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Delete power supply if a power supply that can provide power for the exit devices is integrated into the automatic operator.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Doors are normally closed and secured.
2. Authorized access by card reader retracts the exit device latches and cycles auto operators.
3. Assisted egress by actuator retracts the exit device latches and cycles auto operators.
4. Egress free for immediate exit.
5. REX switch in push rails allow authorized exit without alarm condition.
6. Door position switches monitor open/closed status.
7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 16.0

Doors: 2.2100C, 2.3100B

Description: PANIC DEVICE - CLOSER - BADGE ACCESS

3 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK NRP-HVY	US26D	MK
1 Electric Hinge, Hvy Wt	T4A3786-MCK QC__	US26D	MK ⚡
1 Rim Exit Device, Nightlatch	7100 B MELR AU627F	630	YA ⚡
1 Cylinder	As Required to Match Existing Key System		

1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
3 Silencer	608-RKW		RO
1 Frame Wire Harness	QC-C1500P		MK ⚡
1 Door Wire Harness	QC-C*** (length / type as required)		MK ⚡
1 Position Switch	DPS-M/W-BK (as required per application)		SU ⚡
1 Card Reader	Provided By Security Supplier		OT ⚡
1 Power Supply	AQD Series		SU ⚡
1 Wiring/Point-to-Point Diagram			
1 Elevation Diagram			
1 Riser Diagram			

Notes:

- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Where possible install closers on door for optimum aesthetics.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Door is normally closed and secured.
2. Authorized access by card reader retracting exit device latch for predetermined time limit.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 17.0

Doors: H.2.0101

Description: PANIC DEVICE - BADGE ACCESS & AUTO ACTUATOR

1 Continuous Hinge	CFM__HD1 SER__ x Length Required		PE	⚡
1 Fire Rated Rim Exit, Nightlatch	7100F B MELR AU627F	630	YA	⚡
1 Cylinder	As Required to Match Existing Key System			
1 Auto Operator	Per Automatic Operator Section		OT	⚡
1 Actuator	By Auto Operator Provider		OT	⚡
1 Armor Plate	K1050 F 36" high CSK BEV	US32D	RO	
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO	
1 Gasketing	S88BL (head & jambs)		PE	
1 Frame Wire Harness	QC-C1500P		MK	⚡
1 Door Wire Harness	QC-C*** (length / type as required)		MK	⚡
1 Position Switch	DPS-M/W-BK (as required per application)		SU	⚡
1 Card Reader	Provided By Security Supplier		OT	⚡
1 Power Supply	AQD Series		SU	⚡
1 Wiring/Point-to-Point Diagram				
1 Elevation Diagram				
1 Riser Diagram				

Notes:

- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Delete power supply if a power supply that can provide power for the exit devices is integrated into the automatic operator.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Door is normally closed and secured.
2. Authorized access by card reader retracts the exit device latch and cycles auto operator.
3. Assisted egress by actuator retracts the exit device latch and cycles auto operator.
4. Egress free for immediate exit.
5. REX switch in push rail allows authorized exit without alarm condition.
6. Door position switch monitors open/closed status.
7. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 18.0

Doors: H.1.0102

Description: PAIR - PANIC DEVICE - AUTO ACTUATOR

2 Continuous Hinge	CFM__HD1 SER__ x Length Required		PE	⚡
2 Fire Rated Surf Vert Rod, Passage	7170F90 LBR MELR AU628F	630	YA	⚡
2 Auto Operator	Per Automatic Operator Section		OT	⚡
2 Actuator	By Auto Operator Provider		OT	⚡
2 Armor Plate	K1050 F 36" high CSK BEV	US32D	RO	
2 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO	
2 Astragal	18061CNB x Door Height		PE	
1 Gasketing	S88BL (head & jambs)		PE	
2 Frame Wire Harness	QC-C1500P		MK	⚡
2 Door Wire Harness	QC-C*** (length / type as required)		MK	⚡
1 Power Supply	AQD Series		SU	⚡
1 Wiring/Point-to-Point Diagram				
1 Elevation Diagram				

1 Riser Diagram

Notes:

- Delete power supply if a power supply that can provide power for the exit devices is integrated into the automatic operator.
- Coordinate with electrical contractor.

Operational Narrative:

1. Doors are normally closed.
2. Assisted ingress/egress by actuator retracts the exit device latches and cycles auto operators.
3. Egress free for immediate exit.

Set: 19.0

Doors: 1.0116, 2.0107, 3.0107

Description: PANIC DEVICE - NIGHTLATCH FUNCTION - CLOSER

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Rim Exit Device, Nightlatch	7100 AU627F Less Dogging	630	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
3 Silencer	608-RKW		RO

Notes:

- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

Set: 20.0

Doors: 1.1101, 1.3000B, 1.3131, 1.3132, 2.0100A, 2.0100C, 2.0100D, 3.0100A, 3.0100C, 3.0100D

Description: PANIC DEVICE - CLASSROOM FUNCTION - CLOSER

4 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK	US26D	MK
1 Rim Exit Device, Classroom	7100 AU626F	630	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
3 Silencer	608-RKW		RO

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

-Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

Set: 21.0

Doors: ST-1.1B, ST-1.2B, ST-2.1, ST-2.2, ST-3.1, ST-3.2

Description: PANIC DEVICE - PASSAGE FUNCTION - CLOSER

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Fire Rated Rim Exit, Passage	7100F AU628F	630	YA
1 Surface Closer	2800ST	689	NO
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
1 Gasketing	S88BL (head & jambs)		PE
1 Sweep	315CN x Door Width		PE
1 Threshold	271A x L.A.R.		PE

Notes:

-Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

Set: 22.0

Doors: 1.0105, 1.0117, 1.2101, 1.2103, 1.2104B, 2.0109, 2.3104, 2.3131A, 3.0109

Description: ELECTRIC LOCK - CLOSER - BADGE ACCESS

3 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Electric Hinge	TA2714-MCK QC__	US26D	MK ⚡
1 Fail Secure Lock	AUCN 8891 FL LC REX	626	YA ⚡
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO	
3 Silencer	608-RKW		RO
1 Frame Wire Harness	QC-C1500P		MK ⚡
1 Door Wire Harness	QC-C*** (length / type as required)		MK ⚡
1 Position Switch	DPS-M/W-BK (as required per application)		SU ⚡
1 Card Reader	Provided By Security Supplier		OT ⚡
1 Power Supply	AQD Series		SU ⚡
1 Wiring/Point-to-Point Diagram			
1 Elevation Diagram			
1 Riser Diagram			

Notes:

- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.
- Coordinate with electrical, alarm and security contractors.
- Access control panel, security management software and credentials by Security Contractor.

Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim for a predetermined time limit.
3. Egress free for immediate exit.
4. Mortise lock REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 23.0

Doors: 2.3134

Description: PAIR - STOREROOM LOCK

8 Hinge, Full Mortise	TA2714-MCK	US26D	MK
2 Manual Flush Bolt	555 [12" / 72" AFF] / 557 (As Required)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	AUCN 8805FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
2 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
1 Astragal	357C x Door Height		PE
2 Silencer	608-RKW		RO

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

Set: 24.0

Doors: 1.3116, 1.3119, 2.3110, 2.3123, 2.3124, 2.3131B, 2.3137, 2.3138

Description: STOREROOM LOCK

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Storeroom Lock	AUCN 8805FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
3 Silencer	608-RKW		RO

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

Set: 25.0

Doors: 1.0109, 1.0112, 2.0101, 2.0104, 3.0101, 3.0104

Description: STOREROOM LOCK - OVHD STOP

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Storeroom Lock	AUCN 8805FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Overhead Holder/Stop	10-x46	689	NO
3 Silencer	608-RKW		RO

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

Set: 26.0

Doors: 1.0115, 1.0118, 2.0108, 3.0108

Description: STOREROOM LOCK - CLOSER

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Storeroom Lock	AUCN 8805FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO	
3 Silencer	608-RKW		RO

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

-Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

Set: 27.0

Doors: 1.0114, 2.0106, 3.0106

Description: STOREROOM LOCK - CLOSER - MOP PLATE

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Storeroom Lock	AUCN 8805FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Mop Plate	K1050 6" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO	

3 Silencer	608-RKW	RO

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

Set: 30.0

Doors: 2.3130B

Description: CLASSROOM LOCK - OVHD STOP

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Classroom Lock	AUCN 8808FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Overhead Holder/Stop	10-x46	689	NO
3 Silencer	608-RKW	RO	

Notes:

-Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.

Set: 31.0

Doors: 1.3100A, 1.3100B, 1.4000B, 2.3101

Description: CLASSROOM LOCK - CLOSER

4 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK	US26D	MK
1 Classroom Lock	AUCN 8808FL LC	626	YA
1 Cylinder	As Required to Match Existing Key System		
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO

3 Silencer

608-RKW

RO

Notes:

- Provide necessary collars/rings, cams and tailpieces/spindles for all cylinders.
- Where possible install closers on door for optimum aesthetics.

Set: 32.0

Doors: 1.1104, 1.2102, 1.3107, 1.3120, 1.3127, 1.3129, 1.3130, 2.3107, 2.3119, 2.3135

Description: PRIVACY LOCK W/ INDICATOR - CLOSER

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Privacy Lock w/ Indicator	AUCN 8862FL V20	626	YA
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Mop Plate	K1050 6" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
1 Gasketing	S88BL (head & jambs)		PE

Notes:

- Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

Set: 33.0

Doors: 1.1102, 1.2104A, 1.2105, 1.2107, 1.3103, 1.3104, 1.3105, 1.3106, 1.3109, 1.3110, 1.3111, 1.3112, 1.3113, 1.3114, 1.3115, 1.3117, 1.3121, 1.3123, 1.3124, 1.3125, 1.3126, 1.3128, 1.3136, 1.3137, 1.3138, 2.3105, 2.3108, 2.3109, 2.3111, 2.3112, 2.3113, 2.3114, 2.3115, 2.3116, 2.3117, 2.3118, 2.3120, 2.3121, 2.3122, 2.3125, 2.3127, 2.3129, 2.3130A, 2.3132, 2.3133, 2.3136, 2.3142

Description: PASSAGE LATCH

4 Hinge, Full Mortise	TA2714-MCK	US26D	MK
1 Passage Latch	AUCN 8801FL	626	YA

1 Door Stop	406 / 441H (as req'd per app)	US32D/26D RO
3 Silencer	608-RKW	RO

Set: 34.0

Doors: 1.0113A, 1.0119A, 2.0105A, 2.0110A, 3.0105A, 3.0110A

Description: PUSH / PULL - CLOSER

4 Hinge, Full Mortise, Hvy Wt	T4A3786-MCK	US26D	MK
1 Push Plate	70C-RKW	US32D	RO
1 Arm Pull	AP1007	US32D	RO
1 Surface Closer	4400	689	YA
1 Kick Plate	K1050 12" high CSK BEV	US32D	RO
1 Mop Plate	K1050 6" high CSK BEV	US32D	RO
1 Door Stop	406 / 441H (as req'd per app)	US32D/26D	RO
3 Silencer	608-RKW		RO

Notes:

-Closers shall not be installed on corridor side of doors, where possible install closers on door for optimum aesthetics.

Set: 35.0

Doors: 2.1100B, 2.1102, 2.1103, 2.1105, 2.1111, 2.1114, 2.1115, 2.1116, 2.1117, 2.1118, 2.1119, 2.1120, 2.1121, 2.1122, 2.1123, 2.1125, 2.1126, 2.1127, 2.1128, 2.1129, 2.1130, 2.1131, 2.1133, 2.1135, 2.1136, 2.1137, 2.1138

Description: COULD NOT LOCATE ON FLOOR PLANS

END OF SECTION

SECTION 088000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A Insulating glass units.
- B Glazing units.
- C Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A Section 079200 - Joint Sealants: Sealants for other than glazing purposes.
- B Section 081113 - Hollow Metal Doors and Frames
- C Section 084113 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

- A 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- C ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E ASTM C1036 - Standard Specification for Flat Glass; 2016.
- F ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.
- H ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- I ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.
- J ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- K GANA (SM) - GANA Sealant Manual; 2008.
- L ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M ITS (DIR) - Directory of Listed Products; current edition.
- N NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
- O NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2017.
- P NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2020.
- Q NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).
- R NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

- S UL (DIR) - Online Certifications Directory; Current Edition.
- T UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- U UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- V UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 STANDARDS

- A Meet requirements and recommendations of applicable portions of Standards listed:
 - 1. American National Standards Institute. ANSI
 - 2. Consumer Products Safety Council. CPSC
 - 3. Flat Glass Manufacturers Association. FGMA
 - 4. Federal Specifications. FS
 - 5. Governing Codes and Ordinances
 - 6. National Glass Association

1.05 SAFETY REQUIREMENTS

- A Install tempered (or laminated safety glass where noted) at all glass entrances and adjoining sidelites, unless located in fire rated walls; in which case, this glazing shall be wire glass or fire rated glazing as noted.

1.06 SUBMITTALS

- A See Section 013000 - Administrative Requirements, for submittal procedures.
- B Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D Manufacturer's Literature: Submit two copies of manufacturer's specifications, recommendations and installation instructions for each type of glazing sealant and compound, gasket and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown. Show by transmittal that one copy of each recommendation and instruction has been distributed to the Glazier.
- E Certificate: Certify that products of this section meet or exceed specified requirements.
- F Manufacturer's Qualification Statement.
- G Installer's Qualification Statement.

- H Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.07 QUALITY ASSURANCE

- A Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- C Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section

1.08 FIELD CONDITIONS

- A Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

- A See Section 017000 - Closeout Requirements, for additional warranty requirements.
- B Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C By accepting this Contract, the Contractor agrees to warrant his work for one year against becoming unserviceable or objectionable in appearance as a result of being defective or non-conforming. Without limiting the warranty scope, the work shall be warranted not to leak or to break due to faulty installation.

PART 2 PRODUCTS

2.01 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:
 - a. Positive Design Pressure: 43 psf (ultimate wind pressure).
 - b. Negative Design Pressure: 57 psf (ultimate wind pressure).
 - 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.
- 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.

2.02 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. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
 6. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
 7. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.03 INSULATING GLASS UNITS

- A Manufacturers:
 1. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- B Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Vitro: Acuity.

- b. Coating: Low-E (solar control type) Solarban 90, on #2 surface.
- 4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Vitro: Acuity.
- 5. Total Thickness: 1 inch (25.4 mm).

2.04 GLAZING COMPOUNDS

- A Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color selected by Architect.

2.05 ACCESSORIES

- A Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A Examine surfaces and items that are to receive glass. Correct unsatisfactory conditions.
- B Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- C Verify that the minimum required face and edge clearances are being provided.
- D 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.
- E Verify that sealing between joints of glass framing members has been completed effectively.
- F Correct defects that could interfere with proper glazing. Correct warped planes that could place glass in a strain when installed. Do not start glazing until unsatisfactory conditions have been corrected and approved.
- G Proceed with glazing system installation only after unsatisfactory conditions have been corrected.
- H Proceeding with glazing work will be construed as evidence that surfaces to receive glass are in condition to permit satisfactory installation.

3.02 WORKING REQUIREMENTS

- A Handle glass and glazing materials to avoid damage to materials or to work in place.
- B Satisfactorily repair or remove and replace work that has been damaged.

- C Protect glass from scratching, breaking or other injury while storing, during installation and until work is completed.
- D Install temporary coverings necessary to prevent damage to finished surfaces during construction.
- E Tape, or temporarily paint, markings on installed glass sufficient to clearly indicate that glass is in place.
- F Do not remove labels from individual sheets of glass until glazing materials have been installed and approved.
- G Store and handle glass and glazing materials to prevent damage to materials or structure.
- H Remove broken and scratched glass promptly from site.

3.03 PREPARATION

- A Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours 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. D
- D Conditions:
 - 1. Surface shall be dry and free from frost.
 - 2. Unless otherwise recommended by sealant manufacturer, air temperature at elevation at which glazing with liquid sealants is to take place shall be 40 Degrees F or above.

3.04 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.

3.05 INSTALLATION – WET GLAZING METHOD (COMPOUND AND COMPOUND)

- A Application - Interior Glazed: Set glazing infills from the interior of the building.
- B Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (610 mm) centers, kept 1/4 inch (6 mm) below sight line.
- C Locate and secure glazing pane using glazers' clips.
- D Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.06 FIELD QUALITY CONTROL

- A See Section 014000 - 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.
- E Remove soil, stain and extraneous materials caused by glazing from glass and adjacent surfaces. Replace items that cannot be satisfactorily cleaned.
- F Remove and replace glass that is scratched, cracked, broken, discolored or defective.

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 090561 - 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. Rubber sheet.
- B. Testing of concrete floor slabs for moisture and alkalinity (pH).
- C. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
- D. Patching compound.
- E. Remedial floor coatings.
- F. Remedial floor treatment.

1.02 PRICE AND PAYMENT PROCEDURES

- A. Unit Price for Alternate Flooring Adhesive: Do not include the cost of the alternate adhesive in the base bid; state on the bid form the unit price per square foot for using the alternate adhesive, in the event such remediation is required.
- B. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot for the floor coating or underlayment, installed, in the event such remediation is required.

1.03 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- D. ASTM F3513 - Standard Practice for Single Component, Fluid-Applied Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

- A. 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.
- B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - 1. Manufacturer's qualification statement.
 - 2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 - 3. Manufacturer's installation instructions.
- C. 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.
- D. Adhesive Bond and Compatibility Test Report.

1.06 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. 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.
- C. 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.

1.07 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.

1.08 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. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating, Single Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

PART 3 EXECUTION

2.02 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. 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.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Specified remediation, if required.
 - 6. Patching, smoothing, and leveling, as required.
 - 7. Other preparation specified.
 - 8. Adhesive bond and compatibility test.
 - 9. 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: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, 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.

2.03 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.

2.04 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.

2.05 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.

2.06 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. 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.

2.07 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

2.08 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

2.09 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 092116 - 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. Gypsum wallboard.
- F. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

- A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- F. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).
- G. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- 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; 2022.
- 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; 2022.
- M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

- O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
- P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- Q. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- R. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- S. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.
- T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2019.
- U. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on non-wicking supports, in accordance with manufacturer's recommendations.
- B. Store metal products to prevent corrosion.

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 of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

- A. Material and Product Requirements Criteria: AISI S201.
- B. Nonstructural Framing System Components: AISI S220; 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 (L/120 at 240 Pa).

1. Studs: C-shaped with knurled or embossed faces.
 2. Runners: U shaped, sized to match studs.
 3. Ceiling Channels: C-shaped.
- C. Non-structural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company; www.americangypsum.com
 2. CertainTeed Corporation; www.certainteed.com
 3. Georgia-Pacific Gypsum; www.gpgypsum.com
 4. Gold Bond Building Products, LLC provided by National Gypsum Company; www.goldbondbuilding.com
 5. USG Corporation; www.usg.com
- 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.
 3. Thickness:
 - a. As indicated in drawings

2.04 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as indicated in drawings.
- B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- D. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) 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 C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center (at 406 mm 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. Blocking: Install blocking for support of:
 - 1. Framed openings
 - 2. Wall-mounted cabinets
 - 3. Plumbing fixtures
 - 4. Toilet accessories
 - 5. Wall-mounted door hardware
 - 6. Medical Equipment

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.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

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.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.

3.06 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 2. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. 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 (0.8 mm).

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.08 CLEANING

- A. See Section 017000 – Closeout Requirements for additional requirements.

3.09 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 093000 – TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Non-ceramic trim.

1.02 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- C. ANSI A108.1c - Contractor's 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 Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- F. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
- G. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
- H. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- I. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.
- J. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.04 SUBMITTALS

- A. See Section 013000 - 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, thresholds, ceramic accessories, and setting details.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials from freezing or overheating in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.

PART 2 - PRODUCTS

2.01 TILE

- A. Porcelain Floor Tile (PT-1) & (WT-1): ANSI A137.1 standard grade.
 - 1. Size: 12x24, nominal.
 - 2. Thickness: 3/8 inch (9.5 mm).
 - 3. Surface Finish: Matt
 - 4. Color(s): As indicated on drawings.
 - 5. Pattern: As indicated on drawings.
- B. Ceramic Wall Tile (WT-2)
 - 1. Size: 6" Hex.
 - 2. Finish: Glazed
 - 3. Color(s): As indicated on drawings.
 - 4. Pattern: As indicated on drawings.
- C. Porcelain Wall Tile (WT-3)
 - 1. Size 20cm x 120 cm
 - 2. Thickness: 9mm
 - 3. Finish: Matt
 - 4. Color(s): As indicated on drawings
 - 5. Pattern: As indicated on drawings

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
 - 1. Applications:

- a. Transition between floor finishes of different heights.
 - b. Thresholds at door openings.
 - c. Floor-to-wall joints.
 - d. Borders and other trim as indicated on drawings.
2. Products:
- a. Schluter-Systems; www.schluter.com

2.03 GROUTS

- A. Manufacturers:
- 1. Laticrete Products: www.laticrete.com
- B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
- 1. Color(s): To be selected by Architect.

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.

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.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- 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. Install non-ceramic trim in accordance with manufacturer's instructions.
- F. Sound tile after setting. Replace hollow sounding units.

- G. Keep control and expansion joints free of mortar, grout, and adhesive.
- H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- I. Grout tile joints unless otherwise indicated.
- J. 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 CLEANING

- A. Clean tile and grout surfaces.

3.05 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

- A. Section Includes
 - 1. Acoustical ceiling panels
 - 2. Exposed grid suspension system
 - 3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings, Perimeter Trim
- B. Related Sections
 - 1. Section 092116 – Gypsum Board Assemblies
 - 2. Division 23 - HVAC
 - 3. Division 26 - Electrical

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - 2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - 7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 9. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint

- 10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
- 11. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
- 12. ASTM E 1264 Classification for Acoustical Ceiling Products

1.04 SYSTEM DESCRIPTION

- A. Continuous/Wall-to-wall

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.
- B. Samples: Minimum 6-inch x 6-inch samples of specified acoustical panel; 8-inch-long samples of exposed wall molding and suspension system, including main runner and 4-foot cross tees.
- C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.
- D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification, such as Underwriter's Laboratory (UL), of NRC, CAC, and AC.
 - 1. If the material supplied by the acoustical subcontractor does not have an independent laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of, and replaced with complying product at the expense of the Contractor performing the work.

1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer to ensure fit and function.
- B. Installer Qualifications: Company specializing in performing specified work type, a minimum of three years of documented experience, and approved by the manufacturer.
- C. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
- D. Surface Burning Characteristics: Tested per ASTM E 84 and complying with ASTM E 1264 Classification.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.08 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
 - 1. Acoustical Panels with HumiGuard® Max and HumiGuard® Plus performance: sagging and warping
 - 2. Acoustical panels with BioBlock® performance: growth of mold and mildew
 - 3. Grid System: rusting and manufacturer's defects
- B. Warranty Period:
 - 1. Ceiling System: Thirty (30) years from date of substantial completion
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.09 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Ceiling Panels:
 - 1. Armstrong World Industries, Inc.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc.

2.02 ACOUSTICAL CEILING UNITS

A. Acoustical Panel Ceilings

1. Surface Texture: Smooth Texture
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24 in x 24 (ACT-1) and 24x48 (ACT-4)
5. Edge Profile: Square Lay-in
6. Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; Classified with UL label on product carton: 40
7. Flame Spread: ASTM E 1264; Class A
8. Light Reflectance (LR) White Panel: 86%
9. Sound Absorption (NRC): 0.70
10. Indoor Air Quality Certified to SCS-105 v4.2-2023
11. Basis of Design: ULTIMA HEALTH ZONE, 1935, as manufactured by Armstrong World Industries, Inc.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.03 INSTALLATION

- A. Follow manufacturer installation instructions.
- B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.
- C. Suspend main beam from overhead construction with hanger wires spaced 4 feet on center along the length of the main runner. Install hanger wires plumb and straight.

- D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
- E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.
- F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.04 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 095423 - LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Linear metal ceilings.
- B. Suspended metal support system and perimeter trim.
- C. Supplementary insulation above ceiling.

1.02 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023e.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
- F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 DESIGN REQUIREMENTS

- A. Design components to ensure light fixtures and installed accessories will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.
- B. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.05 SUBMITTALS

- A. Product Data: Furnish for component profiles, materials, perimeter and integral trim, and space closures.
- B. Shop Drawings: Indicate reflected ceiling plan and details of junction with dissimilar materials.

- C. Samples: Submit two samples illustrating color and finish of components exposed to view.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Linear Panels: One, standard length.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

1.07 MOCK-UPS

- A. Construct 1 mock-up, 20 feet long by 20 feet wide; include suspension system, panels, closures, light fixtures, and integral mechanical and electrical components in mock-up.
- B. Locate mock-up where directed.
- C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
- B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.09 WARRANTY

- A. See Section 017000 - Closeout Requirements for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Linear Metal Ceilings:
 - 1. Certainteed Architectural; Metal - Deep Box Series; Metal - Deep Box Series - Exterior www.certainteed.com/ceilings-and-walls/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LINEAR METAL CEILINGS

- A. Linear Metal Ceiling System: Panels, suspension members, trim, and accessories as required to provide a complete system.
- B. Performance Requirements:
 - 1. Design to support imposed loads of indicated items without eccentric loading of supports.
 - 2. Design for maximum deflection of $1/360$ of span.

2.03 COMPONENTS

- A. Linear Metal Panels for interior: ACT-2
 - 1. Classification: ASTM E1264, Class A, Type D, Form D1, perforated, aluminum formed sheet.
 - a. Pattern: A - perforated, regularly spaced large holes.
 - b. Backing: Mineral fiber acoustical backing.
 - c. Finish: Custom decorative woodgrain film
 - 2. Type: Linear panel with reveals; directly attached to suspension members.
 - a. Size and Configuration: As indicated on drawings.
 - b. Panel Profile: Deep box 6, roll-formed, 0.20" thick aluminum with square edges
 - c. Perforations: Pattern #160.
 - d. Spacing: $3/4$ " inch reveal between panels.
- B. Linear metal panels for interior: ACT-3
 - 1. Classification: ASTM E1264, Class A, Type D, Form D1, Perforated, Aluminum formed sheet.
 - a. Pattern: A- perforated, regularly spaced large holes.
 - b. Backing: Mineral fiber acoustical backing.
 - c. Finish: Custom decorative woodgrain film
 - 2. Type: Linear panel with reveals, directly attached to suspension members.
 - a. Size and Configuration: As indicated on drawings.
 - b. Panel Profile: Deep box 4, roll-formed, 0.20" thick aluminum with square edges
 - c. Perforations: pattern #160
 - d. Spacing: $3/4$ inch reveal between panels.
- C. Linear Metal Panels for exterior: EC-1
 - 1. Classification: ASTM E1264, Class A, Type D, Form D1, Aluminum formed sheet.
 - a. Pattern: Not Perforated
 - b. Backing: No backing
 - c. Finish: Custom decorative woodgrain film

2. Type: Linear metal plank soffit system for exterior
 - a. Size and Configuration: As indicated on drawings.
 - b. Panel Profile Type: 150F, roll formed .025" thick aluminum; 5-29/32" (150 mm) wide, 3/4" deep, with square interlocking, integral reveal closure edges.
 - c. Perforations: None
 - d. Spacing: none
 - e. Utilize brackets in lieu of wire for this ceiling application.
- D. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.
- E. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
- F. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
- G. Brackets: L-shaped, size recommended by ceiling manufacturer for specified application.
- H. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application and ceiling system flatness requirement specified.
- I. Suspension Wire: Steel, annealed, galvanized finish, 9 gauge, 0.1144 inch diameter.
- J. Touch-up Paint For Concealed Items: Zinc rich type.

2.04 FABRICATION

- A. Shop cut linear panels to accommodate mechanical and electrical items.
- B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels ; back brace internal corners.

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.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Verify that field measurements are as indicated.

3.02 INSTALLATION

- A. Suspension Components:
 1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.

2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
 3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
 4. Locate suspension system for linear panel layout on room axis according to reflected plan.
- B. Linear Metal Ceiling:
1. Install linear panels and other system components in accordance with manufacturer's instructions.
 2. Align end joints.
 3. Butt interior end joints tight.
 4. Install filler strips between linear panels at interior locations.
 5. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
 6. Install end caps at sight-exposed ends of linear panels.

3.03 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.
- C. Maximum Variation From Dimensioned Position: 1/4 inch.

3.04 CLEANING

- A. Clean surfaces.
- B. Replace damaged or abraded components.

END OF SECTION

SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring
- B. Vinyl Composition Tile
- C. Rubber Tile
- D. Resilient base
- E. Rubber Stair Treads
- F. Installation accessories

1.02 SUBMITTALS

- A. See Section 013000 – 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, illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.04 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 (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.05 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Tile: LVT-1
 - 1. Manufacture: Interface
 - 2. Tile Size: 25cm x 1 cm
 - 3. Color: As indicated on drawings
- B. Vinyl Tile: LVT-2
 - 1. Manufacture: Interface
 - 2. Tile Size: 50cm x 50
 - 3. Color: As indicated on drawings
- C. Rubber Tile: RT-1
 - 1. Manufacture: Interface
 - 2. Tile Size: 39.53" x 19.76"
 - 3. Color: As Indicated on drawings
- D. Vinyl Tile: LVT-3
 - 1. Manufacture: Mannington
 - 2. Tile Size: 36" x 4"
 - 3. Color: As indicated on drawings
- E. Vinyl Tile: LVT-4
 - 1. Manufacturer: Interface
 - 2. Tile Size: 5.49" x 48"
 - 3. Color: As indicated on drawings
- F. Vinyl Composition Tile: VCT-1
 - 1. Manufacture: Armstrong
 - 2. Tile Size: 12" x 12"
 - 3. Color: As indicated on drawings
- G. Rubber Stair Tread
 - 1. Manufacture: Interface
 - 2. Thickness: 5mm
 - 3. Color: As indicated on drawings

2.02 RESILIENT BASE

- A. Resilient Base: RB-1
 - 1. Manufacturers: Johnsonite
 - 2. Height: 4 1/4" Reveal

3. Color: As indicated on drawings.
 4. Length: Roll
 5. Corners: Mitered edge
- B. Resilient Base: RB-2
1. Manufactures: Johnsonite
 2. Height: 4" cove
 3. Color: As indicated on drawings.
 4. Length: Roll
 5. Corners: Mitered edge

2.03 ACCESSORIES

- A. Adhesive for Vinyl Tile
1. Waterproof; types recommended by flooring manufacture
- B. Moldings, Transition and Edge Strips
1. Manufactures: Schluter-Systems; VinPro: www.schluter.com

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 required floor-mounted utilities are in correct location.

3.02 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Do not mix manufacturing batches of a color within the same area.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
- E. Do not install resilient flooring over building expansion joints.
- F. Do not install defective or damaged resilient flooring.
- G. It is recommended that all resilient floorcovering installation shall not begin until all other trades are completed.
- H. Remove excess adhesive immediately
- I. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 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. Install with adhesives specified for the site conditions and follow adhesive label for proper use.
- C. Install pattern as indicated by drawings.
- D. Planks should have end joints offset by at least 6" and staggered to create a random appearance.

3.04 INSTALLATION – VINYL COMPOSITE TILE

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacture's installation instructions.
- B. Install pattern as indicated by drawings.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Miter internal and external corners.
- 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. Comply with manufacture's written instructions for cleaning and protection of resilient products.
- C. Sweep and vacuum surfaces thoroughly.
- D. Damp-mop surfaces to remove marks and soil.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. Protect resilient products from mark, indentations, and other damage from construction operations and placement of equipment and fixtures during reminder of construction period.
- C. No heavy traffic, rolling loads or furniture placement for 72 hours after installation.
- D. A regular maintenance program must be start after the initial cleaning.

END OF SECTION

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Epoxy matrix terrazzo with ground and polished finish.
- B. Divider strips.
- C. Wall Base.

1.02 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. NTMA (GRAD) - Aggregate Gradation Standards; Current Edition.
- B. NTMA (EPOXY) - Epoxy Terrazzo Specifications; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.
- C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.
- D. Samples: Submit two samples, 12 inch by 12 inch in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.
- B. Manufacturer's Instructions: In addition to specified requirements, comply with precast terrazzo manufacturer's instructions and recommendations for substrate preparation, materials storage, mixing and application, finishing and curing.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
 - 1. Minimum five years of documented experience.

- D. Installer Qualifications: Company specializing in performing the type of work specified in this section.
 - 1. Minimum five years of documented experience.

1.06 MOCK-UP

- A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 3 by 3 feet.
- B. Locate where directed.
- C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store terrazzo materials in a dry, secure area.
- B. Maintain minimum temperature of 60 degrees F.
- C. Keep products away from fire or open flame.
- D. Precast terrazzo to be palletized and shrink wrapped, delivered in original unopened packaging with legible manufacturer identification, including size, piece number, quantities, manufacturer date and inspector initials.
- E. Precast terrazzo to be stored indoors, in a climate-controlled environment, sheltered from moisture in original packaging. Protect from damage by other trades.

1.08 FIELD CONDITIONS

- A. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.
- B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Resinous Matrix Terrazzo Flooring - Basis of Design: Key Resin; Key Epoxy Terrazzo System
- B. Precast Stair Treads – Basis of Design Wausau Tile.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

- A. Floors:
 - 1. Thickness: 3/8 inch, nominal.
 - 2. Color(s): To be selected by Architect.
 - 3. Aggregate Type: marble and glass chips.
 - 4. Aggregate Size: No. 0-1.

- B. Wall Base:
 - 1. Thickness: Same as floors.
 - 2. Thickness: 3/8 inch, minimum.
 - 3. Style: Straight.
 - 4. Color(s): same as floors.
 - 5. Aggregate Type and Size: Same as floors.
- C. Stairs - Treads, Risers, Stringers, and Landings:
 - 1. Thickness: 3/8 inch, minimum.
 - 2. Color(s): Same as adjacent floor.
 - 3. Aggregate Type and Size: Same as floors.
- D. Precast Epoxy Terrazzo Stair Treads and Risers:
 - 1. Thickness: as recommended by the manufacturer.
 - 2. Color(s): Same as adjacent floor.
 - 3. Aggregate Type and Size: Same as floors.

2.03 MATERIALS

- A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
 - 1. Mix Proportions: As required to achieve appearance specified.
- B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.
- C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.
- D. Finishing Grout: Epoxy, color to match terrazzo matrix.
- E. Precast Epoxy Terrazzo Units: Fabricate to sizes and profiles indicated on drawings.

2.04 ACCESSORIES

- A. Divider Strips: 1/8 inch thick brass exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
- B. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
- C. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.
- D. Anchors and Reinforcement for Precast Units: As recommended by manufacturer for type of installation.

- E. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.

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 terrazzo.
- 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 terrazzo.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 090561.
 - 2. Obtain instructions if test results are not within limits recommended by terrazzo flooring manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Clean substrate of foreign matter.
- B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.
- C. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install divider strips according to pattern approved on shop drawings.
- B. Install non-slip inserts in floors and stair treads where indicated.
- C. Install base divider and control joint strips to match floor pattern.
- D. Install terminating cap strip at top of base; attach securely to wall substrate.
- E. Place terrazzo mix over substrate to thickness indicated.
- F. Anchor precast units as indicated on drawings.
- G. Install precast units using specified setting material.

3.04 FINISHING

- A. Finish terrazzo to NTMA requirements.

- B. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.
- C. Apply grout to fill voids exposed from grinding.
- D. Remove grout coat by grinding, using a fine grit abrasive.
- E. Hand grind vertical and curved surfaces similarly.

3.05 TOLERANCES

- A. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.06 CLEANING

- A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.
- B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.
- C. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

- A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- F. CRI 104 - Standard for Installation of Commercial Carpet; 2018.

1.04 SUBMITTALS

- A. See Section 013000 - 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 location of edge moldings and installation pattern.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting:
 - 1. J&J Flooring: www.jjflooringgroup.com
- B. Walk Off Carpeting:
 - 1. J&J Flooring: www.jjflooringgroup.com

2.02 MATERIALS

- A. Tile Carpeting (CPT-1): , manufactured in one color dye lot.
 - 1. Product: As specified in drawings manufactured by J&J
 - 2. Tile Size: as specified in drawings
 - 3. Color: as indicated on drawings.
- B. Walk-Off Carpeting (WO-1)
 - 1. Product: As specified in drawings manufactured by J&J
 - 2. Tile Size: as specified in drawings.
 - 3. Color: as specified in drawings.

2.03 ACCESSORIES

- A. Edge Strips: Use appropriate Schluter Trim for each application.
- B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

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 subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- 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 carpet tile in ashlar pattern, with pile direction parallel to next unit, set aligned as indicated on shop drawings.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. 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 097200 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and prime painting.
- B. Wall covering and borders.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, illustrating color, finish, and texture. Must provide strike-off of WC-1 for approval.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.04 MOCK-UPS

- A. Provide panel, 2 panel drops wide, full height, illustrating installed wall covering and joint seaming technique.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
 - 2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
- B. Wall Covering - Type II: Vinyl Wallcovering.
 - 1. Total Weight: 20 oz/sq yd.
 - 2. Roll Width: 54 inches.
 - 3. Color: as indicated on drawings .
 - 4. Pattern: as indicated on drawings.
 - 5. Pattern Match: Non-reverse hang; straight across match.
 - 6. Manufacturers:
 - a. As indicated on drawings.
- C. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- D. Substrate Primer and Sealer: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

- E. Marks: Seal with shellac those that may bleed through surface finishes.
- F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Razor trim edges on flat worktable. Do not razor cut on gypsum board surfaces.
- D. Apply wall covering smoothly, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- E. Butt edges tightly.
- F. Overlap adjacent panels as recommended by manufacturer.
- G. Horizontal seams are not acceptable.
- H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- I. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- J. Apply wall covering to electrical wall plates prior to replacing.
- K. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.
- L. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 099000 - PAINTS AND COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior paint and coating commercial systems including surface preparation.

1.2 RELATED SECTIONS

- A. Section 092116 - Gypsum Board Assemblies

1.3 SUBMITTALS

- A. Submit under provisions of Section 013000 - Administrative Requirements.
- B. Product Data: For each paint system indicated, including.
 - 1. Product characteristics.
 - 2. Surface preparation instructions and recommendations.
 - 3. Primer requirements and finish specification.
 - 4. Storage and handling requirements and recommendations.
 - 5. Application methods.
 - 6. Cautions for storage, handling, and installation.
- C. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors and sheens available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish surfaces for verification of products, colors and sheens.
 - 2. Finish area designated by Architect.
 - 3. Provide samples that designate primer and finish coats.
 - 4. Compatibility and Adhesion: Check after one week of drying and curing by testing in accordance with ASTM D3359; Adhesion by tape test. If coating system is incompatible, additional surface preparation up to and including complete removal may be required.
 - 5. Do not proceed with remaining work until the Architect approves the mock-up.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
 - 1. Product name, and type (description).
 - 2. Application and use instructions.
 - 3. Surface preparation.
 - 4. Batch date.
 - 5. Color number.
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal or 1 case, as appropriate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Benjamin Moore Paints

2.2 PAINT MATERIALS - GENERAL

- A. Paints and Coatings:
 - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

- C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.
- D. Color: Refer to Finish Schedule for paint colors, and as selected.

2.3 EXTERIOR PAINT SCHEDULE

- A. Exposed Metal Columns
 - 1. Primer: Sport Prime Benjamin Moore High Performance Universal Metal Primer, HP1320
 - 2. Topcoat: Two Coats Benjamin Moore MultApply Waterborne Acrylic Semi-gloss Enamel, 1190.
- B. CMU
 - 1. Filler: One coat Benjamin Moore Ultra Spec Hi-Build Masonry Block Filler, 571.
 - 2. Topcoat: two coats Benjamin Moore Ultra Spec Masonry Elastomeric Waterproofing Coating Low Lustre, 360.
- C. Galvanized Metal Lintels
 - 1. Primer: One coat Benjamin Moore MultApply Waterborne Acrylic Semi-Gloss Enamel, 1190.

2.4 INTERIOR PAINT AND COATING COMMERCIAL SYSTEMS

- A. Sealed Concrete
 - 1. Topcoat: Two coats Benjamin Moore Ins1-x Tuffcrete Solvent Acrylic Waterproofing Concrete Stain, CST-51xx.
- B. Drywall: Walls, Gypsum Board and similar items.
 - 1. Primer: One coat Benjamin Moore Drywall Primer, 380.
 - 2. Topcoat: Two coats Benjamin Moore Ultra Spec 500 Interior Satin, T545.
- C. Hollow Metal Doors & Frames:
 - 1. Primer: One coat Benjamin Moore Acrylic Metal Primer, HP1100.
 - 2. Topcoat: Two coats Benjamin Moore MultApply Waterborne Acrylic Semi-Gloss Enamel, 1190.
- D. Gypsum Ceilings:
 - 1. Primer: One coat Benjamin Moore Drywall Primer, 380.
 - 2. Topcoat: Two coats Benjamin Moore Ultra Spec 500 interior Flat, T535.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

- B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.
- C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead-based paints, notify Architect immediately if lead-based paints are encountered.

3.2 SURFACE PREPARATION

- A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
 - 1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
 - 2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
 - 3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
 - 4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.
- B. Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

3.3 INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.
- B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.
- C. Apply coatings using methods recommended by manufacturer.

- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.
- G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.4 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.

3.5 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 101400 – SIGNAGE & GRAPHICS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior Code Required and Wayfinding Signs
- B. Dimensional Letters/Logos
- C. Printed Wall Graphics
- D. Cut Vinyl Graphics
- E. Exterior Signage

1.02 SUBMITALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork and braille layout.
- C. Samples: For each sign material indicated that involves color selection.

1.03 QUALITY ASSURANCE

- A. Supplier: Obtain all signage products in this and other signage specifications through a single supplier from a single manufacturer. Installer of signs must be the fabricator of signs. No third parties allowed.
- B. Regulatory Requirements: Products shall meet requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications.
- C. Installer: Installation shall be performed by installer specialized and experienced in work similar to that required for this project.
- D. Sign supplier to provide ONLINE REORDER website for use by owner to order additional signs. Reorder website to include sign descriptions, sign drawings & sign cost.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 PRODUCTS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
- B. Acceptable Manufacturers:

1. ASI Signage Innovations:
 - a. Contact: Kristen L. Moore; kristen.moore@asisignage.com
 - b. Cell Phone: 504-554-1561; Office: 504-704-1000
 2. No approved substitutions
- C. Signage Types:
1. Code Required and Wayfinding Signage
 - a. Sizes, materials, and mounting methods details are to comply with “Interior Sign Standards & Specifications” dated February 2026 – v.1.0. Refer to signage sheets for thumbnails of signs.
 - b. ASI 3D Form Series ADA Ready Signs
 - c. Quantities: See signage sheets
 - d. Sign Types:
 - i. Room ID
 - ii. Office ID
 - iii. Flag ID
 - iv. Directional ID
 - v. Directional ID
 - vi. On-Door Notice
 - vii. Directory ID
 - viii. Elevator ID (with Evacuation Map)
 - ix. Stairwell ID
 - x. Star ID
 - xi. Regulatory ID
 - xii. Exit ID
 - xiii. Restroom ID
 2. Interior Dimensional Letters/Logos
 - a. Sizes, materials, and mounting methods details are to comply with “Interior Sign Standards & Specifications” dated February 2026 – v.1.0. Refer to interior elevations sheets for sizes and copy of letters.
 - b. ASI LPP Series Laser Cut Acrylic Letters
 3. Printed Wall Graphics
 - a. ASI LTV Series Digitally Printed Wall Graphics
 - b. Product: 3M Ij180mC-10 with DPF 3220 Cast Overlamine in Matte Finish
 - c. General Contractor to provide Level 5 Sheetrock finish with Kilz primer (or similar approved brand by ASI)

- d. Artwork provided by ASI with any high-resolution images or logo elements to be supplied by Owner/Architect. In person meeting(s) with entire project team to be schedule to kick-off design process, if required.
 - e. Refer to interior elevation sheets for sizes and locations.
4. Cut Vinyl Graphics
- a. ASI LTV Series Cut Vinyl Graphics
 - b. Frosted Film:
 - i. Standard Etch-Look Frosted Film, Applied First Surface, Full-Coverage
 - c. Tenant/Suite Door Vinyl:
Standard Cast White, High Performance Vinyl, to Include the Suite Name, Hours of Operation, and Contact Information
5. Exterior Signage
- a. Sizes, materials, and mounting methods details are to comply with “Exterior Sign Standards & Specifications” dated February 2026 – v.1.1.
 - b. ASI LF Series Internally Illuminated Logos/Letters
 - c. Quantities: See exterior signage sheets
 - d. Sign Types:
 - i. Signage – West (Face-Lit)
 - ii. Signage – South Tau (Face-Lit)
 - iii. Signage – South Logo/Letters (Halo-Lit)
 - iv. Signage – South Main Entrance (Face-Lit)
 - e. Electrical Coordination:
 - i. Signs are to not have any external power runs. All electrical wires from each letter are to run through inside of the building.
 - ii. General contractor is responsible for proper sequencing of letter installation to ensure ASI has full access behind wall to run individually mounted/run letter wires. If the wall cannot remain open, general contractor is responsible for drilling locations with ASI provided template and running pull string through to the exterior of the building.
 - iii. General contractor is responsible for ensuring transformers are accessible within the interior of the building for servicing. If a drop ceiling is not available, general contractor is to provide access panel in wall.
 - iv. General contractor is to coordinate with electrician bringing power to location of signs.
 - v. General contractor is to coordinate with electrician on/off operation of sign with other external lighting

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
 - 1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - 2. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to glass.
 - 3. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass conceal mounting materials.
- C. Dimensional Characters: Mount character, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 - 1. Stud Mounting: Mount characters at base (bottom) of each letter into exterior channel.
- D. Cast-Metal Plaques: Mount plaques using standard fastening methods recommended in writing by manufacturer for type of wall surface indicated.
 - 1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

END OF SECTION

SECTION 102113 - TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. SECTION INCLUDES
 - 1. High Pressure Laminate Toilet Cubicles.
 - 2. High Pressure Laminate Urinal Screens.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Blocking in walls to secure panels
- B. Section 092116 - Gypsum Board Assemblies
- C. Section 093000 - Tiling: Layout and installation
- D. Section 102800 - Toilet, Bath, & Laundry Accessories

1.03 REFERENCE STANDARDS

- A. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- B. ICC A117.1 – Accessible and Usable Buildings and Facilities, 2017.

1.04 PRE-INSTALLATION MEETING

- A. Conduct conference at site location as directed by Owner to review mock-ups.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's data sheets for toilet cubicle system and urinal screens.
- B. Shop drawings: Illustrate material, details, dimensions, elevations, accessories, and anchorage locations for toilet cubicle system.
 - 1. Include the design engineer's stamp or seal on each sheet of shop drawings.
- C. Samples: Submit color samples of high-pressure laminate, hardware and accessories to illustrate material, color, and texture.

1.06 QUALITY ASSURANCE

- A. Accessibility Requirements
 - 1. Americans with Disabilities Act (ADA).
 - 2. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
- B. Manufacturer: Provide products manufactured by a company with a minimum of 10 years' successful experience manufacturing similar products.

1.07 MOCK-UPS

- A. Provide mock-up of HPL cubicle system including hardware and accessories to show the full system in use.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Schedule material for proper delivery and protection.

1.09 WARRANTY

- A. Manufacturer's standard 10-year warranty for materials and workmanship including door hardware, aluminum frame and mounting brackets.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: Design based on Ribbon HPL as manufactured by Thrislington
 - 1. Contact Shane Mouton at shane@archspecinc.com for a list of local authorized distributors and installers.
- B. Substitutions: The Architect will consider comparable products submitted as substitutions in accordance with the Project Manual, including documentation of five projects of similar size installed for a minimum of five years.

2.02 HIGH PRESSURE LAMINATE COMPONENTS

- A. Door: 29mm ultra lightweight MDF core edged with 2mm HPL for a 31mm finished thickness.
 - 1. Hand lipped rebated doors for flush finish and zero sight lines. Concealed inserts for attachment to stainless steel pivots.
- B. Fascia: 63mm finished thickness consisting of 12mm moisture resistant MDF core panels, edged and faced in HPL. Attached to the aluminum framework.
 - 1. If fascia exceeds 150mm, support with a stainless-steel foot.
- C. Divider: 17mm finished thickness consisting of 15mm moisture resistant MDF core panels, edged and faced in HPL.
- D. Frame: Extruded concealed aluminum framework with visible internal framework made of aluminum alloy 6063T6 with a 5-micron anodized finish.
 - 1. Headrail: Aluminum headrail finished on external face in chosen finish.
- E. Privacy: Minimal 5mm gaps between vertical edges of door and framework. Aluminum framework provides privacy between compartments and is not visible from the exterior.
- F. Floor-anchored, overhead braced cubicles:
 - 1. Height: 98 ½ inches.
 - 2. Toe clearance: 4 inches.
- G. Urinal Screens: Floor-anchored (Gamma).
 - 1. Height: To be determined.
 - 2. Depth: 24 inches
 - 3. Toe Clearance: 9 inches.
- H. Color: Premium grade laminate TBD

2.03 HARDWARE AND ACCESSORIES

A. Hardware Fittings:

1. ADA Compliance: Stainless Steel door handle is operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed five pounds.
2. Emergency Access: Latch allows door to be opened from outside compartment with emergency release key on the occupancy indicator.
3. Mounting: Divider fixed to back wall using concealed steel brackets with visible through-fixings and supported by a stainless steel pedestal.

B. Door Hardware:

1. Materials: Precision engineered 303 grade brushed stainless steel.
2. Locking: Fixed through the door to the faceplate, which displays occupancy by a red indicator for locked and white indicator for unlocked.
 - a. Sacrificial hard nylon shear tips on the lock finger, which locates into the flush aluminum receiver.
3. Top door pivot suspended from the structural aluminum headrail and the bottom pivot located onto a post fixed pivot bracket.
4. Coat Hook: Stainless steel buffered coat hook as standard.

C. Closing System: Doors soft-close by means of a hydraulic closer and fits within the structural aluminum headrail.

1. No visible external fixings, including outswing doors with internal pivots.
2. Hydraulic closer prevents door from opening beyond 95 degrees on outswing doors and incorporates a restrictor which comes into operation when door is opened to 90 degrees.
 - a. Hydraulic closer tested over a cycle of 300,000 operations.
 - b. Door closes from 90-degree position between 12 and 17 seconds.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare substrates including using methods recommended by the manufacturer for project conditions.
- B. Inspect areas scheduled to receive cubicles for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 1. Verify spacing of plumbing fixtures to assure compatibility with installation of cubicles.
 2. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

- C. Do not proceed with installation until the substrates have been properly prepared with blocking and supports in walls at points of and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Installation must be performed by a trained and certified Thrislington dealer/installer. Contact Shane@archspecinc.com or 817-521-9357 for the local authorized Thrislington dealer.
- B. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 - 1. Verify blocking and supports in walls have been installed properly at points of attachment.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Use fasteners and anchors suitable for substrate and project conditions.
 - 4. Install unit's rigid, straight, plumb, and level.
 - 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 6. Test for proper operation.
 - 7. Verify that gaps between fascia panels and doors are blocked and ensure privacy.

3.03 ADJUSTING, CLEANING AND PROTECTION

- A. Verify self-closing doors shut between 12 and 17 seconds when in a 90-degree position.
- B. Touch-up, repair or replace damaged products.
- C. Clean exposed surfaces of cubicles, hardware, and fittings.

END OF SECTION

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.
- B. Protective Wall Panel.
- C. Fiberglass reinforced plastic (FRP).

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

- A. See Section 013000 - 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. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. 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.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Inspect materials at delivery to assure that specified products have been received.
- C. Protect work from moisture damage.
- D. Protect work from UV light damage.
- E. 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.
- F. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Corridor Handrails and Corner Guards:
 - 1. Inpro: www.inprocorp.com
- B. Protective Wall Panel:

1. Inpro: www.inprocorp.com
- C. IPC Aspex Wall Protection
- D. Fiberglass Reinforced Plastic (FRP)
 1. Panolam: www.panolam.com

2.02 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 1. Width of Wings: 3"
 2. Color: As indicated in drawings
 3. Length: Full Height
 4. Preformed end caps.
- B. Protective Wall Panel: WP-1, WP-2 WP-3
 1. Size: 4'x10'
 2. Thickness: .060" WP-1; .040" WP-2 & WP-3
 3. Color: As indicated on drawings
 4. Accessories: Use color matching caulk to seal all edges
- C. Fiberglass Reinforced Plastic
 1. Size: 4'x8'
- D. Adhesives and Primers: As recommended by manufacturer.

2.03 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 substrate surfaces for adhered items are clean and smooth.
- C. Complete all finishing operations, including painting, before beginning installation of sheet materials.
- D. Wall surfaces shall be dry and free from dirt, grease and loose paint.

3.02 PREPARATION

- A. Surfaces Prep: Prior to installation, clean the substrate to remove dust, debris and loose particles. Insure the substrate is sound and per project plans.
- B. Acclimate product in temperatures between 65 degrees and 80 degrees and a humidity level less than 80% 24 hours in advance of installation.

- C. The area of installation must be temperature and humidity controlled for at least 48 hours after installation.

3.03 INSTALLATION

A. Corner Guard

1. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
2. Position corner guard above rubber base.

B. Wall Protection

1. Install ridged sheet as indicated on the approved detail drawing for the appropriate substrate and in compliance with the installation instructions.
2. Install level and plumb at the height indicated on the drawings.
3. Adhere to substrate with manufacturer's approved adhesive.
4. Smooth roll surface.

3.04 CLEANING

- A. Clean wall protection items of excess adhesive, dust, dirt, and other contaminants in accordance with the cleanup and maintenance instructions of the various products.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet and healthcare accessories

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

1.03 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.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 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.

2.02 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.03 COMMERCIAL TOILET AND HEALTHCARE ACCESSORIES

- A. Mirrors:
 - 1. MR-1: 24x36 Bobrick # B-290 series at locations indicated on drawings.
- B. Toilet Tissue Dispensers:
 - 1. TPD-1: Georgia Pacific, compact side-by side 2-roll dispenser for 2 rolls. Dimensions: 11"W x 7"H x 6.75"D. Provide one for each toilet – color black.
- C. Robe Hooks:
 - 1. RH-1: Bobrick b-6717, Satin Finish. Located at all restrooms as indicated on the drawings.
- D. Paper Towel Dispensers:
 - 1. PTD-1: Paper towel dispenser for sink locations, San Jamar T1900XC chrome C-fold/ multi fold. Provide one per sink location unless noted otherwise.

- E. Grab Bars:
 - 1. Bobrick b-5806 series with concealed mounting as shown on drawings. Provide concealed anchor plates for stud walls.
 - a. GB-1: B-5806, satin finish, 36" long; restroom locations indicated on drawings
 - b. GB-2: B-5806, satin finish, 42" long; restroom locations indicated on drawings
- F. Soap Dispensers:
 - 1. SD-1: Ecolab, Nexa Classic, manual, white, #53004893. Provide one per lavatory or sink location.
- G. Hand Sanitizer:
 - 1. HS-1: Ecolab, Next Generation manual dispenser. Provide in locations provided on the Wall Finish Plans.
- H. Trash Can
 - 1. TC-1: Uline, Rubbermaid Office Trash Can, 7 gallon, Item #S-9970, Color: Beige.
- I. Specimen Pass-through Cabinet:
 - 1. SPC-1: Bobrick, B0=-505; Satin-finish
- J. Trash Grommet:
 - 1. TG-1: Doug Mocket, TM1B, 6" Dia x 2" deep, Steel Grommet.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

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. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Grab Bars: 36" Max to the top of the bar.
 - 2. Mirrors: 40", measured from floor to bottom of the reflective surface.
 - 3. Paper Towel Dispenser: between 40"-48", measured from floor to bottom of paper opening.
 - 4. Robe Hook: 60" AFF
 - 5. Toilet Tissue Dispensers: 8" in front to the middle of the dispenser and 15" Min. AFF.

6. Soap Dispensers: 44"-48" AFF unless otherwise noted on the interior elevations.
7. Hand Sanitizer: 44"-48" AFF unless otherwise noted on the interior elevations.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fire extinguishers.
 - 2. Extinguisher cabinets.
- B. Related Requirements:
 - 1. Section 013000 – Administrative Requirements: For administrative and procedural requirements for processing of submittals during the construction phase.
 - 2. Section 017000 – Closeout Requirements: For administrative and procedural requirements for completion of the Work.

1.02 ACTION SUBMITTALS

- A. Submit in accordance with Section 013000:
 - 1. Product Data:
 - i. Cabinets: Materials description for fire extinguisher cabinets include roughing-in dimensions, details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, door style and materials.
 - ii. Extinguishers: Materials description for fire extinguishers; include ratings and classifications.
 - iii. Installation instructions for each product specified.
 - 2. Shop Drawings:
 - i. Small-scale plans showing locations of fire extinguisher cabinets and individual fire extinguishers.
 - ii. Schedules showing each type of cabinet and extinguisher to ensure proper fit and function.
 - iii. Indicate installation procedures and accessories required for a complete installation.

1.03 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

- A. Provide fire extinguishers, cabinets and accessories produced by a single manufacturer.
- B. Provide fire extinguishers of type approved by UL, State Fire Marshal's Office, and local regulatory agencies, if any.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle fire protection specialties and related materials using means and methods that will prevent damage, deterioration, or loss.

1. Deliver components in manufacturer's original packaging, properly labeled for identification.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION SPECIALTIES MANUFACTURERS

- A. Acceptable Manufacturers:
- JL Industries, a division of Activar Construction Products Group, Inc.

2.02 FIRE EXTINGUISHERS

- A. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
 2. Finish: Factory powder-coated; Red.
 3. Effectiveness (Rating): Class A, B, and C fires.
 4. Model Identification and UL Rating: Cosmic 5E; 3A-40BC

2.03 EXTINGUISHER CABINETS

- A. Cabinet with Aluminum Trim and Door: Academy Series
1. Cabinet Style: Semi-recessed
 2. Components:
 - i. Tub: Anodized aluminum; clear color.
 - ii. Door and Trim Construction: Aluminum; flush doors with 5/8 inch (15.88 mm) doorstop attached by continuous hinge and equipped with zinc-plated handle with roller catch.
 1. Finish: Factory-anodized finish.
 - a. Standard Color: Clear.
 2. Trim Style and Depth:
 - a. Recessed Cabinet: 3/8 inch (9.53 mm) flat trim.
 - b. Semi-Recessed Cabinet:
 - i. Rolled Edge
 - iii. Fire-Rating: Non-fire-rated

2.04 SOURCE QUALITY CONTROL

- A. Ship extinguishers to the Project site fully charged, EXCEPT those which contain water as an extinguishing agent, if any.
- B. Obtain Fire Extinguishers and Fire Extinguisher Brackets from same manufacturer to ensure compatibility.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed and blocking where surface mounted cabinets will be installed.
 - 1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - 2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
 - 3. Maintain fire ratings where cabinets are recessed into fire-rated wall systems.
- B. Wall Signs:
 - 1. Location: Where shown or directed.
 - 2. Apply on walls after field painting is completed and has been accepted.

3.03 FIELD QUALITY CONTROL

- A. Ensure that each extinguisher is fully charged, and that inspection of each extinguisher has been performed, as evidenced by the National Association of Fire Equipment Distributors certification tag, just prior to turnover.

3.04 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire protection cabinets that cannot be restored to factory finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

117000 – MEDICAL EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Coordination requirements for Owner-provided medical equipment.
- B. Interface requirements between medical equipment and building systems, including power, telecommunications, structural support, mechanical, plumbing and finishes.
- C. Delivery, staging, and installation coordination with Owner and medical equipment vendors.

1.02 RELATED SECTIONS

- A. Division 01 – Administrative Requirements

1.03 OWNER-FURNISHED ITEMS

- A. All medical equipment described in this Section is listed in the attached schedule. Required installer is listed within.
- B. Manufacturer's product data, utility requirements, MEQ plan, and installation requirements are provided to the Contractor for coordination purposes.

1.04 COORDINATION RESPONSIBILITIES

- A. The General Contractor shall:
 - 1. Coordinate building and infrastructure readiness for installation of Owner-furnished medical equipment.
 - 2. Verify field conditions and ensure all required rough-ins match approved equipment data.
 - 3. Provide access, temporary protection, and safe working conditions for Owner's installers.
 - 4. Coordinate scheduling of deliveries and installations to avoid conflicts with construction activities.
 - 5. Provide blocking, structural supports, backing plates, sleeves, utility rough-ins and final utility connections where indicated.
 - 6. Protect installed equipment until final acceptance.

1.05 QUALITY ASSURANCE

- A. Coordination meetings will be required with Owner, GC, Architect, and Equipment Vendors.

PART 2 - PRODUCTS

1.01 MEDICAL EQUIPMENT

- A. Medical Equipment Report, organized by Room Name and Room Number, is attached for reference. Refer to drawings, Sheet Q01.0, for Overall Equipment Plan.
- B. Medical Equipment Cutbook is attached for reference.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to receive work of this Section.
- B. Ensure blocking is provided in walls as required.
- C. Verify utility requirements for each item of equipment and provide mechanical and electrical rough-in service, as required.
- D. Notify Architect of any existing conditions which will adversely affect execution.

3.02 PREPARATION

- A. Prepare substrate surfaces as recommended by manufacturer.
- B. Complete all associated building work, including utilities, supports, and finishes, prior to equipment installation.
- C. Owner will proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PROTECTION

- A. Protect equipment during subsequent construction activities.

3.04 CLEANING AND CLOSEOUT

- A. Clean areas affected by GC work.
- B. Submit record documents showing final utility connection locations, routing, and any deviations from Contract Documents.
- C. Participate in final walk-through with Owner and equipment vendors.

END OF SECTION



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

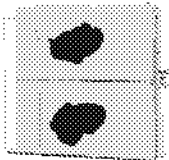
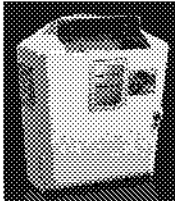
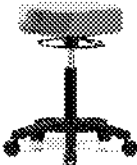
FLOOR:
DEPARTMENT: 1) LAB
ROOM NAME: BLOOD DRAW (QTY 3)
ROOM #: 3.1.1103

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 CAPHH-035	3	CART, PROCEDURE, PHLEBOTOMY PHLEBOTOMY/SPECIMEN COLLECTION CART. REMOVABLE ABS PLASTIC MOLDED TOP. GATELOCK FOR SECURITY. FIVE DRAWERS. 12 CLEAR PLASTIC TILT... WxDxH: 24.00 IN x 24.00 IN x 45.00 IN WEIGHT: * LOCATION: MOBILE	MEDLINE INDUSTRIES INC. MPH01WMLP2 PHLEBOTOMY CART MPH01WMLP2	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 CHBLD-088	2	CHAIR, CLINICAL, BLOOD DRAW FULLY ADJUSTABLE FLIP-UP PADDED ARMS. UPHOLSTERED. WEIGHT CAPACITY IS 300 POUNDS. 7" ARM HEIGHT. WxDxH: 35.00 IN x 30.00 IN x 37.00 IN WEIGHT: 60.00 LB LOCATION: FLOOR	MARKETLAB INC. UPHOLSTERED STANDARD HGT BLOOD DRAW CHAIR, MANUAL 15923-XX	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 CHBAR-054	1	CHAIR, CLINICAL, BLOOD DRAW, BARIATRIC ADJUSTABLE FLIP-UP PADDED ARMS. SUPPORTS UP TO 500 POUNDS. UPHOLSTERED. SEAT HEIGHT 23"; SEAT WIDTH 30"; ARM HEIGHT ADJUSTMENT RAN... WxDxH: 43.00 IN x 29.00 IN x 43.00 IN WEIGHT: 70.00 LB LOCATION: FLOOR	MARKETLAB INC. EXTRA-WIDE TALL HGT BLOOD DRAW CHAIR, MANUAL 15929-XX	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) LAB
ROOM NAME: BLOOD DRAW (QTY 3)
ROOM #: 3.1.1103

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 GLVDB-025	3	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
 SHRWM-010	3	SHARPS, DISPOSAL, WALL MOUNT LOCKED SHARPS CONTAINER MOUNTING ALLOWS FOR SECURE POINT OF USE DISPOSAL OF SHARPS. FOR CONVENIENCE, ALL CABINETS ARE UNIVERSALLY ... WxDxH: 14.50 IN x 6.50 IN x 17.50 IN WEIGHT: 3.00 LB LOCATION: WALL	COVIDIEN COVIDIEN LOCKING WALL CABINET 85301H 85301H	NEW RESP: OF/CI GROUP: 1-FIXED
 STLEC-190	3	STOOL, EXAM, CUSHION-SEAT VINYL; 3" FOAM; DESK HEIGHT; BLACK DUAL WHEEL CASTERS; 250 LB CAPACITY; HEIGHT ADJUSTABLE;14.75" SEAT DIAMETER; SPECIFY COLOR WxDxH: 21.00 IN x 21.00 IN x 23.00 IN WEIGHT: LOCATION: MOBILE	SOURCE MEDICAL PERCH LIFE LFLN	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) LAB
ROOM NAME: BLOOD DRAW (QTY 3)
ROOM #: 3.1.1103

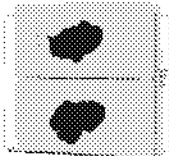
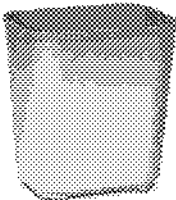
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	3	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) LAB
ROOM NAME: PROCESSING
ROOM #: 3.3.1105

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 GLYDB-025	1	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
 REFLU-067	1	REFRIGERATOR, LABORATORY, UNDERCOUNTER 2.5 CF; SOLID DOOR; RIGHT HINGED; 1-0TO DEGREES C TEMPERATURE RANGE; DIGITAL TEMP DISPLAY; AUDIBLE/ VISUAL ALARMS; 2 PROBES; ADJUS... WxDxH: 17.75 IN x 19.50 IN x 28.78 IN WEIGHT: 68.00 LB LOCATION: FLOOR	AMERICAN BIOTECH SUPPLY ABT-HC-UCFS-0204 ABT-HC-UCFS-0204	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: OFFICE
ROOM #: 3.1.1102

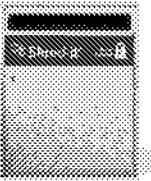
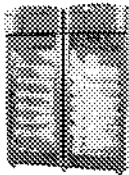
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: PRESCRIPTIONS
ROOM #: 3.1.2101

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
BISHR-005 	1	BIN, SHREDDING ACCOMMODATES 250 PIECES OF PAPER. PAPER SECURELY HELD POLYESTER BAG FOR RETRIEVAL. LOCKING DOOR. WxDxH: 20.25 IN x 19.50 IN x 26.00 IN WEIGHT: 60.00 LB LOCATION: FLOOR	SHRED-IT, INC. MINI CONSOLE MINI CONSOLE	NEW RESP: OF/VI GROUP: 3-MOVABLE, NON-ELECT
REFPO-047 	1	REFRIGERATOR, PHARMACEUTICAL, 1 DOOR 1-DOOR PHARMACEUTICAL REFRIGERATOR. FEATURES: 115V ELECTRICAL. 25.2 CU. FT., 1, DUAL-PANE GLASS, RIGHT-HINGE. +2°C TO +10°C TEMPER... WxDxH: 29.00 IN x 37.70 IN x 78.30 IN WEIGHT: 517.00 LB LOCATION: FLOOR	HELMER SCIENTIFIC I.SERIES IPR125-GX (115V) 5115125-1	NEW RESP: OF/CI GROUP: 2-MOVABLE, ELECT
REFPT-003 	1	REFRIGERATOR, PHARMACEUTICAL, 2 DOOR REFRIGERATOR, PHARMACEUTICAL, 2 DOOR WxDxH: 59.25 IN x 38.50 IN x 79.50 IN WEIGHT: 876.00 LB LOCATION: FLOOR	HELMER SCIENTIFIC I.SERIES IPR256 5105256-1	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

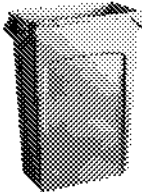
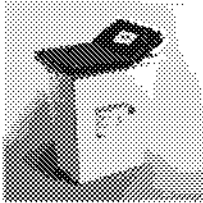
FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: PRESCRIPTIONS
ROOM #: 3.1.2101

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
RFMDU-014	1	REFRIGERATOR, UNDERCOUNTER, MEDICAL GRADE RIGHT HINGE; 4.5 CF; SOLID DOOR; CYLINDER LOCK; 2.2 TO 10 DEGREES C; AUDIBLE/ VISUAL ALARMS WxDxH: 23.75 IN x 27.00 IN x 34.00 IN WEIGHT: 170.00 LB LOCATION: FLOOR	FOLLETT CORPORATION REF5P PERFORMANCE PLUS REF5P-OR-00-00	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
SHLMS-040	8	SHELVING, MODULAR STORAGE CLASSIC STYLE RX SHELVING WxDxH: 15.00 IN x 7.50 IN x 84.00 IN WEIGHT: LOCATION: FLOOR **LIKELY CUSTOM BUILT CF/CI; PLACEHOLDER ONLY.	QC STORAGE, LLC RXWA15	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
SHLMS-041	27	SHELVING, MODULAR STORAGE CLASSIC STYLE RX SHELVING WxDxH: 36.00 IN x 7.50 IN x 84.00 IN WEIGHT: LOCATION: FLOOR **LIKELY CUSTOM BUILT CF/CI; PLACEHOLDER ONLY.	QC STORAGE, LLC RXWA36	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: PRESCRIPTIONS
ROOM #: 3.1.2101

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 SFTPO-008	1	SOFTWARE, PHARMACY, ORDER MANAGEMENT COMPUTER INFO SYSTEM, DATA MGT, PHARMACY WxDxH: N/A x N/A x N/A WEIGHT: N/A LOCATION: SPECIAL	BD MEDICAL TECHNOLOGY STOCKSTATION BD-38764	NEW RESP: OF/VI GROUP: 6-IT/COMPUTERS
 WSTTR-028	2	WASTE CAN, 20-31 GALLON 23-GALLON WASTE. VENTING CHANNELS, FOUR BAG CINCHES. HANDLES AT THE BASE AND RIM OF THE CONTAINER. RIM WITH RIB-STRENGTHENED DESIG... WxDxH: 11.00 IN x 22.00 IN x 30.00 IN WEIGHT: 7.80 LB LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 92 QT./23 GALLON SLIM JIM GRAY RECTANGULAR TRASH CAN FG354060GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 WSTPH-006	2	WASTE CAN, PHARMACEUTICAL LABELED EXCLUSIVELY FOR NON-RCRA PHARMACEUTICAL WASTE. LEAK-RESISTANT GASKET AND ABSORBENT PAD. FEATURES A HINGED LID. BLUE. WxDxH: 10.75 IN x 15.25 IN x 17.00 IN WEIGHT: * LOCATION: FLOOR	STERICYCLE 8 GALLON PHARMACEUTICAL CONTAINER 8850	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: RR
ROOM #: 3.1.2102

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: MEDS (NARCOTICS)
ROOM #: 3.1.2103

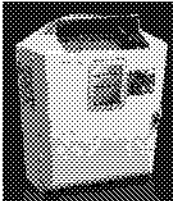
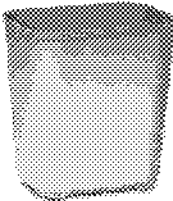
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
SHLMS-041	3	SHELVING, MODULAR STORAGE	QC STORAGE, LLC	NEW
		CLASSIC STYLE RX SHELVING	RXWA36	
		WxDxH: 36.00 IN x 7.50 IN x 84.00 IN		
		WEIGHT:		RESP: OF/OI
		LOCATION: FLOOR		GROUP: 3-MOVABLE, NON-ELECT
		**LIKELY CUSTOM BUILT CF/CI; PLACEHOLDER ONLY.		

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

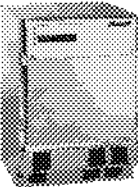
FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: SHOT
ROOM #: 3.1.2104

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
SHRWM-010 	1	SHARPS, DISPOSAL, WALL MOUNT LOCKED SHARPS CONTAINER MOUNTING ALLOWS FOR SECURE POINT OF USE DISPOSAL OF SHARPS. FOR CONVENIENCE, ALL CABINETS ARE UNIVERSALLY ... WxDxH: 14.50 IN x 6.50 IN x 17.50 IN WEIGHT: 3.00 LB LOCATION: WALL	COVIDIEN COVIDIEN LOCKING WALL CABINET 85301H 85301H	NEW RESP: OF/CI GROUP: 1-FIXED
WSTOT-005 	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
END OF ROOM				



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: SHIPPING STORAGE
ROOM #: 3.1.2105

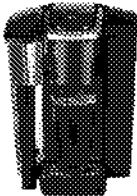
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 CACFT-028	2	CART, SUPPLY, CHROME, 42 INCH 5 TIER; BOTTOM SHELF INLAY; LABEL HOLDERS, CASTERS WxDxH: 42.00 IN x 18.00 IN x 80.00 IN WEIGHT: LOCATION: MOBILE **INCLUDE CASTERS AND SOLID BOTTOM	QC STORAGE, LLC 1842FM7-5-02 1842FM7-5-02	NEW RESP: OF/VI GROUP: 3-MOVABLE, NON-ELECT
 FRZMU-005	1	FREEZER, UNDERCOUNTER, MEDICAL GRADE RIGHT HINGE; 4.5 CF; -18 TO 37 DEGREES C; SOLID DOOR; CYLINDER LOCK; AUDIBLE/VISUAL ALARM WxDxH: 23.75 IN x 27.00 IN x 34.00 IN WEIGHT: 170.00 LB LOCATION: FLOOR	FOLLETT CORPORATION FZR5P PERFORMANCE PLUS FZR5P-0R-00-00	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

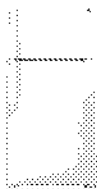
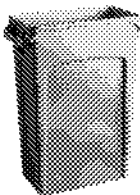
FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: BREAK ROOM
ROOM #: 3.1.2107

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
CFMSC-046 	1	COFFEE MAKER, SINGLE CUP SINGLE CUP COFFEE MAKER. BREWS 4 CUP SIZES (6, 8, 10, AND 12 OZ.) AND IS LARGE ENOUGH TO ACCOMMODATE A TRAVEL MUG. 96 OZ. WATER RE... WxDxH: 10.25 IN x 12.10 IN x 12.35 IN WEIGHT: 10.20 LB LOCATION: COUNTER	KEURIG GREEN MOUNTAIN K-1550 SINGLE-SERVE COMMERCIAL COFFEE MAKER K-1550	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
ICENC-060 	1	ICE MACHINE, DISPENSER, NUGGET, COUNTERTOP AIR COOLED; SENSOR SAFE; WATER DISPENSER; 12LB ICE STORAGE CAPACITY; 425LB PRODUCTION PER 24 HRS TO INCLUDE: 1) AF10LBLEGS 4... WxDxH: 16.12 IN x 23.50 IN x 36.64 IN WEIGHT: 144.00 LB LOCATION: COUNTER	FOLLETT CORPORATION SYMPHONY PLUS 12CI425A-S 12CI425A-S	NEW RESP: OF/CI GROUP: 1-FIXED
OVMNC-139 	1	OVEN, DOMESTIC, MICROWAVE, COUNTERTOP AIR FRY. CONVECTION. BROIL. PRESET CONTROLS. 1,050 WATTS COOKING POWER. 1.0 CUBIC FOOT CAPACITY. TIME COOK I & II. CHILD LOCK. COO... WxDxH: 20.60 IN x 16.60 IN x 11.88 IN WEIGHT: 34.80 LB LOCATION: COUNTER	GE APPLIANCES 1.0 CU. FT. CAPACITY COUNTERTOP MICROWAVE JES1109RRSS	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

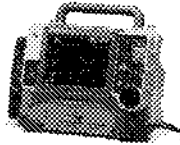
FLOOR:
DEPARTMENT: 1) RETAIL PHARMACY
ROOM NAME: BREAK ROOM
ROOM #: 3.1.2107

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 REFDF-129	1	REFRIGERATOR, DOMESTIC, W/FREEZER GE 21.9 CU. FT. TOP-FREEZER REFRIGERATOR. DUAL CONTROL: SEPARATE TEMPERATURE CONTROLS FOR FRESH-FOOD AND FREEZER SECTIONS. HIGH-... WxDxH: 32.75 IN x 34.50 IN x 66.38 IN WEIGHT: 202.00 LB LOCATION: FLOOR	GE APPLIANCES 21.9 CU. FT., GTS22KGNRWW GTS22KGNRWW	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 WSTTR-028	1	WASTE CAN, 20-31 GALLON 23-GALLON WASTE. VENTING CHANNELS, FOUR BAG CINCHES. HANDLES AT THE BASE AND RIM OF THE CONTAINER. RIM WITH RIB-STRENGTHENED DESIG... WxDxH: 11.00 IN x 22.00 IN x 30.00 IN WEIGHT: 7.80 LB LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 92 QT./23 GALLON SLIM JIM GRAY RECTANGULAR TRASH CAN FG354060GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
END OF ROOM				



LOOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ALCOVE, EKG / RESUSC CART
ROOM #:

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 CAPRE-234	1	CART, PROCEDURE, RESUSCITATION FIVE DRAWER; LOCKING BAR; PEGBOARD SIDE PANELS; CORD-WRAP DOUBLES AS HANDLE; 2 FIXED AND 2 LOCKING SWIVEL CASTERS. WxDxH: 32.75 IN x 20.00 IN x 33.50 IN WEIGHT: LOCATION: MOBILE	HEALTHCARE LOGISTICS FIVE-DRAWER MOBILE WORK CENTER 17935	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 DFBMP-044	1	DEFIBRILLATOR, MONITOR, W/PACING DEFIBRILLATOR/MONITOR WITH ADAPTIVE BIPHASIC, MANUAL AND AED, COLOR LCD DISPLAY, CRP METRONOME, NONINVASIVE PACING, 100MM PRINTER.... WxDxH: 15.80 IN x 9.25 IN x 12.50 IN WEIGHT: 20.10 LB LOCATION: COUNTER	PHYSIO-CONTROL INC. LIFEPAK 15 (BASIC) 99577-001930	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 ECGIN-029	1	ELECTROCARDIOGRAPH (ECG), INTERPRETIVE BUILT ON GE'S INNOVATION IN ECG ACQUISITION AND ANALYSIS, THE MAC* 5500 HD IS GE'S PREMIER ECG SYSTEM, DELIVERING ADVANCED DISEASE... WxDxH: 19.00 IN x 27.00 IN x 40.70 IN WEIGHT: 81.00 LB LOCATION: MOBILE	GE HEALTHCARE - CARDIOLOGY MAC 5500 HD W/CART 2053900-013/CART	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ALCOVE, EKG/SCALE (QTY 2)
ROOM #:

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 ECGIN-072	1	ELECTROCARDIOGRAPH (ECG), INTERPRETIVE MICROPROCESSOR AUGMENTED AUTOMATIC ELECTROCARDIOGRAPH; 10-LEADWIRE ACQUISITION WITH PROGRAMMABLE LEAD CONFIGURATION. MARQUETTE 12S... WxDxH: 13.00 IN x 15.95 IN x 8.67 IN WEIGHT: 15.44 LB LOCATION: COUNTER	GE HEALTHCARE - CARDIOLOGY MAC 7 RESTING ECG MAC 7	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 MONVT-049	2	MONITOR, PHYSIOLOGIC, VITAL SIGNS, W/STAND THE WELCH ALLYN SPOT 4400 VITAL SIGNS MONITOR IS AN AUTOMATED, STATE-OF-THE-ART AND RELIABLE MEDICAL DEVICE DESIGNED TO CAPTURE, A... WxDxH: 23.00 IN x 23.00 IN x 49.00 IN WEIGHT: 20.72 LB LOCATION: MOBILE	WELCH ALLYN, INC., A HILL-ROM COMPANY SPOT VITAL SIGNS 4400 DEVICE W/ SURETEMP, NIBP 44XT-B / 4400-MBS	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 SCLAF-009	1	SCALE, CLINICAL, ADULT, DIGITAL, FLOOR THE MODEL 500KL / 500KG EYE LEVEL DIGITAL BEAM SCALE USES HIGHLY SOPHISTICATED MICROPROCESSOR TECHNOLOGY. THIS PRECISION SCALE IS ... WxDxH: 14.13 IN x 21.13 IN x 53.63 IN WEIGHT: 21.00 LB LOCATION: FLOOR	HEALTH O METER, INC. 500KL 500KL	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ALCOVE, EKG/SCALE (QTY 2)
ROOM #:

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
SPHAM-014	1	SPHYGMOMANOMETER, ANEROID, MOBILE LIFETIME CALIBRATION WARRANTY. NEW 5-LEG STAND. CERTIFIED ACCURACY TO +/- 3MMHG. LATEX- AND MERCURY-FREE. ROUNDED EDGES. LASER-ENG... WxDxH: 19.00 IN x 19.00 IN x 76.00 IN WEIGHT: * LOCATION: MOBILE	WELCH ALLYN, INC., A HILL-ROM COMPANY 767 MOBILE ANEROID ON 5-LEG STAND (W/O CUFF) 7670-03K	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ALCOVE, WHEELCHAIR SCALE
ROOM #:

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 SCLAW-440	1	SCALE, CLINICAL, ADULT, WHEELCHAIR SIDE GUIDE RAILS FOR ADDITIONAL PATIENT AND WHEELCHAIR MANEUVERABILITY. 1,000 LB / 450 KG CAPACITY. 2-WAY EASY-ACCESS WHEELCHAIR R... WxDxH: 75.00 IN x 40.00 IN x 45.00 IN WEIGHT: 143.00 LB LOCATION: MOBILE **MAY NEED TO ADJUST TO NEW ADA VERSION (5,000-5,700)	DETECTO 7150-AC ADA-COMPLIANT WHEELCHAIR SCALE 7150-AC	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



LOLO ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: FACILITATOR
ROOM #: 3.2.140

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: WAITING
ROOM #: 3.2.3100

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	2	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CHECK IN
ROOM #: 3.2.3101

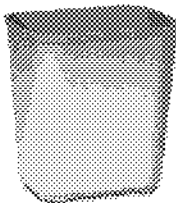
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CHECK OUT/ COPY
ROOM #: 3.2.3102

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
BISHS-022 	1	BIN, SHREDDING, SECURE PAPER DISPOSAL CONSOLE. 80 TO 100 LBS. OF PAPER BAG CAPACITY AND 30 GALLONS DRY GALLON CAPACITY. FULL GLUE AND DOWEL ASSEMBLY. 180... WxDxH: 19.00 IN x 16.00 IN x 35.00 IN WEIGHT: 50.00 LB LOCATION: FLOOR	JAKE, CONNER AND CREW E2 CONSOLE (35 IN.) E2 CONSOLE (35 IN.)	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
WSTOT-005 	2	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT, GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: NURSE MANAGER
ROOM #: 3.2.3103

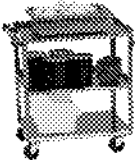
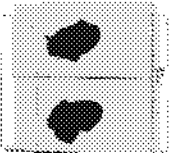
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

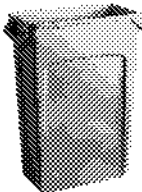
FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: DRUG CLOSET
ROOM #: 3.2.3104

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
CAUME-010 	1	CART, UTILITY, METAL UNITIZED ELECTRONICALLY WELDED ANGLE LEG FRAME. 20 GAUGE STAINLESS STEEL REINFORCED SHELVES. PROTECTIVE BUMPERS ON LEGS AND HANDLE... WxDxH: 19.00 IN x 31.00 IN x 32.00 IN WEIGHT: * LOCATION: MOBILE	LAKESIDE MANUFACTURING, INC. STAINLESS STEEL UTILITY CART,422 422	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
GLVDB-025 	1	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
RFMDU-014 	1	REFRIGERATOR, UNDERCOUNTER, MEDICAL GRADE RIGHT HINGE; 4.5 CF; SOLID DOOR; CYLINDER LOCK; 2.2 TO 10 DEGREES C; AUDIBLE/ VISUAL ALARMS WxDxH: 23.75 IN x 27.00 IN x 34.00 IN WEIGHT: 170.00 LB LOCATION: FLOOR **DRUG SAMPLE REFRIGERATOR (REPLACING EXISTING THAT'S IN THEIR LOUNGE AREA - RESIDENTIAL GRADE)	FOLLETT CORPORATION REF5P PERFORMANCE PLUS REF5P-0R-00-00	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: DRUG CLOSET
ROOM #: 3.2.3104

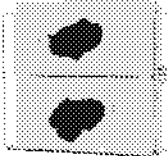
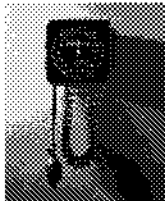
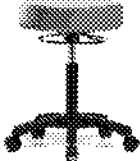
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
WSTTR-028	1	WASTE CAN, 20-31 GALLON	RUBBERMAID COMMERCIAL PRODUCTS	NEW
		23-GALLON WASTE. VENTING CHANNELS, FOUR BAG CINCHES. HANDLES AT THE BASE AND RIM OF THE CONTAINER. RIM WITH RIB-STRENGTHENED DESIG...	92 QT./23 GALLON SLIM JIM GRAY RECTANGULAR TRASH CAN	
		WxDxH: 11.00 IN x 22.00 IN x 30.00 IN	FG354060GRAY	
		WEIGHT: 7.80 LB		RESP: OF/OI
		LOCATION: FLOOR		GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CONSULT, POD 1 - SOUTH (QTY 8)
ROOM #: 3.2.3105, 3.2.3108, 3.2.3109, 3.2.3111, 3.2.3112, 3.2.3113, 3.2.3114, 3.2.3115

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 GLVDB-025	8	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
 SPHAW-007	8	SPHYGMOMANOMETER, ANEROID, WALL MOUNT LARGE, EASY-TO-READ 6 INCH LUMINESCENT DIAL WITH BOLD WHITE PRINTING ON CONTRASTING BLACK CLOCK FACE FOR HIGH VISIBILITY IN VIRTUA... WxDxH: 6.00 IN x 4.00 IN x 6.00 IN WEIGHT: * LOCATION: WALL	MCKESSON LUMEON, 2-TUBE ADULT ARM 01-750W-11ABKGM	NEW RESP: OF/OI GROUP: 1-FIXED
 STLEC-190	8	STOOL, EXAM, CUSHION-SEAT VINYL; 3" FOAM; DESK HEIGHT; BLACK DUAL WHEEL CASTERS; 250 LB CAPACITY; HEIGHT ADJUSTABLE;14.75" SEAT DIAMETER; SPECIFY COLOR WxDxH: 21.00 IN x 21.00 IN x 23.00 IN WEIGHT: LOCATION: MOBILE	SOURCE MEDICAL PERCH LIFE LFLN	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CONSULT, POD 1 - SOUTH (QTY 8)
ROOM #: 3.2.3105, 3.2.3108, 3.2.3109, 3.2.3111, 3.2.3112, 3.2.3113, 3.2.3114, 3.2.3115

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 STLPS-053	8	STOOL, STEP BLACK, POWDER-COATED, 18-GAUGE STEEL WITH 1-INCH TUBING DIAMETER. PROVIDES A TOTAL WEIGHT BEARING CAPACITY OF 350 LBS. NON-SLIP, R... WxDxH: 14.25 IN x 11.25 IN x 8.75 IN WEIGHT: 5.00 LB LOCATION: FLOOR	MCKESSON 8.75" 1 STEP STOOL 16-11200	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 TBLMA-148	7	TABLE, EXAM/TREATMENT, MANUAL ADJUST MANUAL EXAM TABLE WITH PNEUMATIC-ASSIST BACK HAVE A 500LB WEIGHT CAPACITY, AND REVERSIBLE SIDE AND FRONT STORAGE DRAWERS (5 DRAWER... WxDxH: 28.00 IN x 74.50 IN x 32.75 IN WEIGHT: 241.00 LB LOCATION: FLOOR	UMF MEDICAL 5250 5250	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 TBLPW-077	1	TABLE, EXAM/TREATMENT, POWERED 650 POUND PATIENT WEIGHT. ADJUSTABLE HEIGHT. CASTERS. PREMIUM UPHOLSTERY. PELVIC TILT: 5 1/5°. HEATED DRAWER: 24.6 WATT. TAMPER-RE... WxDxH: 28.00 IN x 76.00 IN x 37.00 IN WEIGHT: 435.00 LB LOCATION: FLOOR **CONSULT ROOM #02	MIDMARK CORP 626 BARRIER-FREE POWER 626-001	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CONSULT, POD 1 - SOUTH (QTY 8)
ROOM #: 3.2.3105, 3.2.3108, 3.2.3109, 3.2.3111, 3.2.3112, 3.2.3113, 3.2.3114, 3.2.3115

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
	8	WASTE CAN, SWING TOP	SIMPLE HUMAN LLC	EXISTING
		BLACK; 16 GALLON; RECTANGULAR; PLASTIC	CW1333	
		WxDxH: 13.25 IN x 16.75 IN x 32.75 IN	CW1333	
		WEIGHT:		RESP: OF/OI
		LOCATION: N/A		GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: NURSE STATION (QTY 2)
ROOM #: 3.2.3106, 3.2.3126

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 OPHDT-033	2	OTO/OPHTHALMOSCOPE, SET, DESKTOP COAXIAL LED OPHTHALMOSCOPE; MACROVIEW BASIC LED OTOSCOPE; UNIVERSAL DESK CHARGER, (2) LITHIUM ION RECHARGEABLE HANDLES WxDxH: 6.90 IN x 7.10 IN x 6.20 IN WEIGHT: 4.05 LB LOCATION: COUNTER	WELCH ALLYN, INC., A HILL-ROM COMPANY WELCH ALLYN 71-SM2LDX DIAGNOSTIC DESK 71-SM2LDX	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 WSTOT-005	4	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE- RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: RR (QTY 2)
ROOM #: 3.2.3107, 3.2.3119

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	2	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: STORAGE, HOUSEKEEPING
ROOM #: 3.2.3110

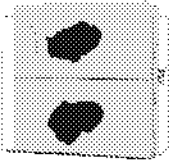
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
DSPSO-040 	1	DISPENSER, CLEANING SOLUTION WxDxH: 18.50 IN x 7.50 IN x 24.25 IN WEIGHT: 15.00 LB LOCATION: WALL 5/26/25- LOURDES USES ECOLAB, CONTRACTED	DIVERSEY CARE 10C407/D3754220	NEW RESP: OF/OI GROUP: N/A
WSTFV-014 	1	WASTE CAN, 44-55 GALLON BRUTE PLASTIC OPEN WASTE CAN WITH DOLLY. NO LID. 44-GALLON, GRAY. FEATURES: COMMERCIAL- GRADE CONSTRUCTION, VENTING CHANNELS, BAG C... WxDxH: 24.00 IN x 24.00 IN x 37.50 IN WEIGHT: 19.00 LB LOCATION: MOBILE 5/26/25- PROVIDED BY SODEXO	RUBBERMAID COMMERCIAL PRODUCTS BRUTE VENTED 44 GAL/GRAY W/DOLLY FG264360GRAY/FG264000BLA	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ECHO (QTY 2)
ROOM #: 3.2.3116, 3.2.3122

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
CHIMG-011 	2	CHAIR, CLINICAL, IMAGING UPHOLSTERED SADDLE-SHAPED SEAT. SEAT SLIDER STANDARD. 2-POSITION TILT LOCK. CENTER KNOB TENSION ADJUSTMENT. 360° SWIVEL. PNEUMATIC... WxDxH: 28.74 IN x 28.74 IN x 50.00 IN WEIGHT: 28.66 LB LOCATION: MOBILE	HAG HAG CAPISCO 8106	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
GLVDB-025 	2	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
STLPH-046 	2	STOOL, STEP, W/HANDRAIL STOOL WITH HANDLE, KNOCKED-DOWN. REINFORCED SLIP-RESISTANT RUBBER TIPS FOR ADDED STABILITY. CHROME-PLATED STEEL FRAME. NON-SLIP TE... WxDxH: 13.50 IN x 18.75 IN x 34.00 IN WEIGHT: 10.40 LB LOCATION: FLOOR	DMI SAFETY STEP STOOL WITH HANDLE, SILVER AND BLACK 539-1902-0099	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ECHO (QTY 2)
ROOM #: 3.2.3116, 3.2.3122

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
TIMUE-014 	2	TABLE, IMAGING, ULTRASOUND, ECHOCARDIOGRAPH STORAGE SHELF; SIDE PANEL LEGS; 3" FOAM; 10X12" DROP AWAY SECTION WxDxH: 27.00 IN x 76.00 IN x 31.00 IN WEIGHT: LOCATION: FLOOR	HAUSMANN INDUSTRIES ECHO-SCAN 4892	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
ULTCE-045 	1	ULTRASOUND, IMAGING, CARDIAC/ECHO AI-BASED CAPABILITIES; ADVANCED DIAGNOSTICS SOLUTIONS; AUTO SEGMENTAL WALL MOTION SCORING; 3D AUTO FLOW COLOR QUANTIFICATION; 21.6... WxDxH: 23.90 IN x 43.00 IN x 67.50 IN WEIGHT: 230.00 LB LOCATION: MOBILE	PHILIPS HEALTHCARE - IMAGING SYSTEMS EPIQ CVX 795231	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
ULTCE-045 	1	ULTRASOUND, IMAGING, CARDIAC/ECHO AI-BASED CAPABILITIES; ADVANCED DIAGNOSTICS SOLUTIONS; AUTO SEGMENTAL WALL MOTION SCORING; 3D AUTO FLOW COLOR QUANTIFICATION; 21.6... WxDxH: 23.90 IN x 43.00 IN x 67.50 IN WEIGHT: 230.00 LB LOCATION: MOBILE	PHILIPS HEALTHCARE - IMAGING SYSTEMS EPIQ CVX 795231	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: ECHO (QTY 2)
ROOM #: 3.2.3116, 3.2.3122

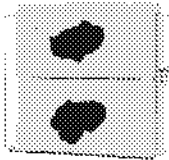
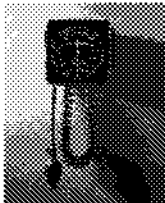
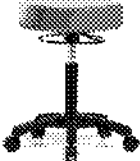
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
WSTST-059	2	WASTE CAN, SWING TOP	SIMPLE HUMAN LLC	EXISTING
		BLACK; 16 GALLON; RECTANGULAR; PLASTIC	CW1333	
		WxDxH: 13.25 IN x 16.75 IN x 32.75 IN	CW1333	
		WEIGHT:		RESP: OF/OI
		LOCATION: N/A		GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CONSULT, POD 2 - NORTH (QTY 7)
ROOM #: 3.2.3117, 3.2.3118, 3.2.3120, 3.2.3121, 3.2.3125, 3.2.3127, 3.2.3129

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 GLVDB-025	7	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
 SPHAW-007	7	SPHYGMOMANOMETER, ANEROID, WALL MOUNT LARGE, EASY-TO-READ 6 INCH LUMINESCENT DIAL WITH BOLD WHITE PRINTING ON CONTRASTING BLACK CLOCK FACE FOR HIGH VISIBILITY IN VIRTUA... WxDxH: 6.00 IN x 4.00 IN x 6.00 IN WEIGHT: * LOCATION: WALL	MCKESSON LUMEON, 2-TUBE ADULT ARM 01-750W-11ABKGM	NEW RESP: OF/OI GROUP: 1-FIXED
 STLEC-190	7	STOOL, EXAM, CUSHION-SEAT VINYL; 3" FOAM; DESK HEIGHT; BLACK DUAL WHEEL CASTERS; 250 LB CAPACITY; HEIGHT ADJUSTABLE;14.75" SEAT DIAMETER; SPECIFY COLOR WxDxH: 21.00 IN x 21.00 IN x 23.00 IN WEIGHT: LOCATION: MOBILE	SOURCE MEDICAL PERCH LIFE LFLN	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CONSULT, POD 2 - NORTH (QTY 7)
ROOM #: 3.2.3117, 3.2.3118, 3.2.3120, 3.2.3121, 3.2.3125, 3.2.3127, 3.2.3129

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 STLPS-053	7	STOOL, STEP BLACK, POWDER-COATED, 18-GAUGE STEEL WITH 1-INCH TUBING DIAMETER. PROVIDES A TOTAL WEIGHT BEARING CAPACITY OF 350 LBS. NON-SLIP, R... WxDxH: 14.25 IN x 11.25 IN x 8.75 IN WEIGHT: 5.00 LB LOCATION: FLOOR	MCKESSON 8.75" 1 STEP STOOL 16-11200	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 TBLMA-148	3	TABLE, EXAM/TREATMENT, MANUAL ADJUST MANUAL EXAM TABLE WITH PNEUMATIC-ASSIST BACK HAVE A 500LB WEIGHT CAPACITY, AND REVERSIBLE SIDE AND FRONT STORAGE DRAWERS (5 DRAWER... WxDxH: 28.00 IN x 74.50 IN x 32.75 IN WEIGHT: 241.00 LB LOCATION: FLOOR	UMF MEDICAL 5250 5250	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 TBLMA-148	3	TABLE, EXAM/TREATMENT, MANUAL ADJUST MANUAL EXAM TABLE WITH PNEUMATIC-ASSIST BACK HAVE A 500LB WEIGHT CAPACITY, AND REVERSIBLE SIDE AND FRONT STORAGE DRAWERS (5 DRAWER... WxDxH: 28.00 IN x 74.50 IN x 32.75 IN WEIGHT: 241.00 LB LOCATION: FLOOR	UMF MEDICAL 5250 5250	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: CONSULT, POD 2 - NORTH (QTY 7)
ROOM #: 3.2.3117, 3.2.3118, 3.2.3120, 3.2.3121, 3.2.3125, 3.2.3127, 3.2.3129

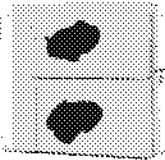
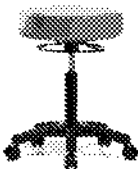
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 TBLPW-077	1	TABLE, EXAM/TREATMENT, POWERED 650 POUND PATIENT WEIGHT. ADJUSTABLE HEIGHT. CASTERS. PREMIUM UPHOLSTERY. PELVIC TILT: 5 1/5°. HEATED DRAWER: 24.6 WATT. TAMPER-RE... WxDxH: 28.00 IN x 76.00 IN x 37.00 IN WEIGHT: 435.00 LB LOCATION: FLOOR **CONSULT ROOM #11	MIDMARK CORP 626 BARRIER-FREE POWER 626-001	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 WSTST-059	7	WASTE CAN, SWING TOP BLACK; 16 GALLON; RECTANGULAR; PLASTIC WxDxH: 13.25 IN x 16.75 IN x 32.75 IN WEIGHT: LOCATION: N/A	SIMPLE HUMAN LLC CW1333 CW1333	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: PROCEDURE - STRESS TEST (QTY 2)
ROOM #: 3.2.3131, 3.2.3133

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 GLVDB-025	2	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
 STLEC-190	2	STOOL, EXAM, CUSHION-SEAT VINYL; 3" FOAM; DESK HEIGHT; BLACK DUAL WHEEL CASTERS; 250 LB CAPACITY; HEIGHT ADJUSTABLE;14.75" SEAT DIAMETER; SPECIFY COLOR WxDxH: 21.00 IN x 21.00 IN x 23.00 IN WEIGHT: LOCATION: MOBILE	SOURCE MEDICAL PERCH LIFE LFLN	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 STSTM-000	2	STRESS TEST SYSTEM, W/TREADMILL 450 POUND WEIGHT CAPACITY. 0 TO 13.5 MPH BELT SPEED RANGE. 3.0 HP MOTOR. 1/10TH HP ELEVATION MOTOR. 0 TO 25% GRADE, CONTINUOUSLY V... WxDxH: 29.00 IN x 77.00 IN x 45.50 IN WEIGHT: 400.00 LB LOCATION: FLOOR NORAV, SPECIFICATIONS PENDING	UNSPECIFIED UNSPECIFIED	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: PROCEDURE - STRESS TEST (QTY 2)
ROOM #: 3.2.3131, 3.2.3133

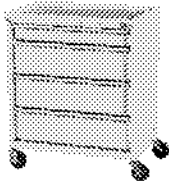
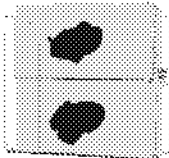
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 STSTM-002	2	STRESS TEST SYSTEM, W/TREADMILL N/A WxDxH: 30.00 IN x 80.25 IN x 47.20 IN WEIGHT: 352.00 LB LOCATION: FLOOR	MORTARA INSTRUMENT, INC. QUINTON Q-STRESS W/TM55 N/A	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 TBLPW-077	2	TABLE, EXAM/TREATMENT, POWERED 650 POUND PATIENT WEIGHT, ADJUSTABLE HEIGHT, CASTERS, PREMIUM UPHOLSTERY, PELVIC TILT: 5 1/5°, HEATED DRAWER: 24.6 WATT, TAMPER-RE... WxDxH: 28.00 IN x 76.00 IN x 37.00 IN WEIGHT: 435.00 LB LOCATION: FLOOR	MIDMARK CORP 626 BARRIER-FREE POWER 626-001	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 WSTST-059	2	WASTE CAN, SWING TOP BLACK; 16 GALLON; RECTANGULAR; PLASTIC WxDxH: 13.25 IN x 16.75 IN x 32.75 IN WEIGHT: LOCATION: N/A	SIMPLE HUMAN LLC CW1333 CW1333	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

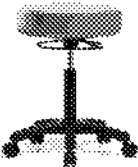
FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: IV TRACER
ROOM #: 3.2.3131

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 CAPGE-185	1	CART, PROCEDURE KEY LOCK WITH TWO KEYS. 3" STEM CASTERS. TWO WITH BRAKE. ROLLER DRAWER SLIDES. REMOVABLE PLASTIC TOP. LATEX FREE. HARD-BAKED POWDE... WxDxH: 23.38 IN x 15.13 IN x 27.25 IN WEIGHT: 48.00 LB LOCATION: MOBILE SHARED, 1 PER POD, **SHARPS WILL BE MOUNTED ON LEFT / GLOVES MOUNTED ON RIGHT. **COLOR: BRUSHED SILVER. SHARED, 1 PER POD	HARLOFF COMPANY, INC. ETC-4 (4 DRWR) ETC-4	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 CHCRT-016	1	CHAIR, CLINICAL, RECLINER, TREATMENT FOOTREST/ BACKREST OPERATE INDEPENDENTLY. UPHOLSTERED ARM. 5" SWIVEL/ BRAKE CASTERS. WxDxH: 40.75 IN x 39.00 IN x 48.00 IN WEIGHT: 168.00 LB LOCATION: MOBILE **RECLINER BY INTERIORS	CAROLINA MODERN AMENITY RECLINER W/TRENDELENBURG 1317	INFO ONLY RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 GLVDB-025	1	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: IV TRACER
ROOM #: 3.2.3131

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
IVSCH-012 	1	STAND, IV, CHROME FIVE LEGS, FOUR-HOOK TOP, HEIGHT ADJUSTABLE 68-99", 3" RUBBER CASTERS, STAINLESS STEEL, EPOXY POWDER COAT FINISH TO INCLUDE:<BR... WxDxH: * x * x 99.00 IN WEIGHT: * LOCATION: MOBILE SPECIFICATION PENDING	PRYOR PRODUCTS, INC. 107 (4-LEG, 4 HOOK) N/A	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
STLEC-190 	1	STOOL, EXAM, CUSHION-SEAT VINYL; 3" FOAM; DESK HEIGHT; BLACK DUAL WHEEL CASTERS; 250 LB CAPACITY; HEIGHT ADJUSTABLE;14.75" SEAT DIAMETER; SPECIFY COLOR WxDxH: 21.00 IN x 21.00 IN x 23.00 IN WEIGHT: LOCATION: MOBILE	SOURCE MEDICAL PERCH LIFE LFLN	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
WSTST-059 	1	WASTE CAN, SWING TOP BLACK; 16 GALLON; RECTANGULAR; PLASTIC WxDxH: 13.25 IN x 16.75 IN x 32.75 IN WEIGHT: LOCATION: N/A	SIMPLE HUMAN LLC CW1333 CW1333	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



LOLO ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: RR, STAFF
ROOM #: 3.2.3135

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	1	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

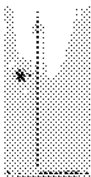
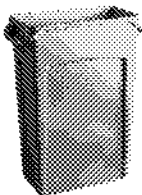
FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: BREAK ROOM
ROOM #: 3.2.3136

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 CFDOM-012	1	COFFEE MAKER, DOMESTIC DOMESTIC COFFEE MAKER. 12-CUP PROGRAMMABLE. BLACK. FEATURES: BREW LATER FEATURE, GRAB-A-CUP AUTO PAUSE, LIFT AND CLEAN FILTER BASK... WxDxH: 8.90 IN x 13.10 IN x 13.80 IN WEIGHT: 4.00 LB LOCATION: COUNTER	MR. COFFEE - A SUNBEAM COMPANY 12-CUP PROGRAMMABLE, BREW NOW OR LATER (BLACK) 2132160	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
 DWTFI-081	1	DISPENSER, WATER, FILTERED HOT/ COLD; DRIP TRAY; ACCOMMODATED 10-20 USERS; 8.7" DISPENSING AREA HEIGHT WxDxH: 13.60 IN x 14.40 IN x 40.20 IN WEIGHT: 61.70 LB LOCATION: FLOOR	WATERLOGIC WL100	EXISTING RESP: OF/CI GROUP: 1-FIXED
 OVNMC-156	1	OVEN, DOMESTIC, MICROWAVE, COUNTERTOP 1.1 CUBIC FOOT CAPACITY. WEIGHT AND TIME DEFROST. TURNTABLE. TWO-STEP CHILD LOCK. INSTANT ON CONTROLS. CONTROL LOCKOUT. 950 MICROW... WxDxH: 20.32 IN x 15.63 IN x 12.00 IN WEIGHT: 30.00 LB LOCATION: COUNTER	GE APPLIANCES 1.1 CU.FT. CAPACITY COUNTERTOP MICROWAVE OVEN GCST11N11WSS	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: BREAK ROOM
ROOM #: 3.2.3136

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
OYNDT-005 	1	OVEN, DOMESTIC, TOASTER STAINLESS STEEL; 4 SLICE; BROIL; BAKE, BAGEL SETTINGS; ADJUSTABLE RACK POSITION; INCLUDES CRUMB TRAY; BAKE PAN AND OVEN RACK WxDxH: 14.76 IN x 11.85 IN x 8.07 IN WEIGHT: 8.00 LB LOCATION: COUNTER	HAMILTON BEACH COMMERCIAL-FOOD SERVICE 4 SLICE TOASTER OVEN 31143	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
REFFS-033 	1	REFRIGERATOR, DOMESTIC, W/FREEZER, SIDE-BY-SIDE DOMESTIC 21 CU. FT. SIDE-BY-SIDE REFRIGERATOR WITH FREEZER. FEATURES: ICE MAKER AND DISPENSER, AUTOMATIC FROST FREE DEFROST SYSTEM... WxDxH: 32.88 IN x 33.83 IN x 66.31 IN WEIGHT: 242.50 LB LOCATION: FLOOR BLACK	SEARS COMMERCIAL (KENMORE) KENMORE 21 CU.FT. WHITE 51752 04651752000	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT
WSTTR-028 	1	WASTE CAN, 20-31 GALLON 23-GALLON WASTE. VENTING CHANNELS, FOUR BAG CINCHES. HANDLES AT THE BASE AND RIM OF THE CONTAINER. RIM WITH RIB-STRENGTHENED DESIG... WxDxH: 11.00 IN x 22.00 IN x 30.00 IN WEIGHT: 7.80 LB LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 92 QT./23 GALLON SLIM JIM GRAY RECTANGULAR TRASH CAN FG354060GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

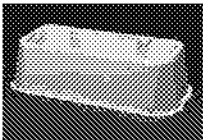
FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: STORAGE
ROOM #: 3.2.3138

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 CACDS-007	1	CART, CYLINDER, D&E, SINGLE CART, CYLINDER, D&E, SINGLE WxDxH: 12.00 IN x 10.00 IN x 41.00 IN WEIGHT: 7.00 LB LOCATION: MOBILE	ANTHONY WELDED PRODUCTS, INC. 6105 CHROME 6C105	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 CACFE-219	1	CART, SUPPLY, CHROME, 48 INCH 5 WIRE SHELVES; 1 CLEAR SHELF INLAY; 5" CASTERS, 2 WITH BRAKES; LABEL HOLDERS WxDxH: 48.00 IN x 18.00 IN x 80.00 IN WEIGHT: NAN LOCATION: MOBILE	QC STORAGE, LLC 1848FM7-5-02 1848FM7-5-02	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 PRGPC-003	1	PROGRAMMER, PACEMAKER PROGRAMMER, PACEMAKER WxDxH: 15.00 IN x 20.00 IN x 5.20 IN WEIGHT: * LOCATION: COUNTER	ABBOTT LABORATORIES (FORMERLY ST. JUDE MEDICAL, INC.) MERLIN PATIENT CARE SYSTEM 3650 3650	EXISTING RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: STORAGE
ROOM #: 3.2.3138

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
CAUPY-013 	1	PROGRAMMER, PACEMAKER, CART CART, UTILITY, POLYMER WxDxH: 18.00 IN x 24.00 IN x 34.00 IN WEIGHT: 20.00 LB LOCATION: MOBILE USE WITH ABBOTT MERLIN	ARMSTRONG MEDICAL AUC-300 AUC-300	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
RCKYF-107 	1	RACK, CYLINDER, FLOOR KEEPS CYLINDERS UPRIGHT AND SECURELY STORED. CHROME PLATED FINISH, ALLOY CARBON STEEL. FOR USE WITH 6 C, D, OR E CYLINDERS. WxDxH: 15.00 IN x 10.20 IN x 8.50 IN WEIGHT: 3.00 LB LOCATION: FLOOR	DRIVE DEVILBISS HEALTHCARE CHROME OXYGEN ECONOMY CYLINDER RACK 18114 18114	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
SHRCT-006 	1	SHARPS, DISPOSAL, COUNTERTOP DISPOSAL, SHARPS, COUNTERTOP WxDxH: 11.00 IN x 7.25 IN x 10.00 IN WEIGHT: 5.00 LB LOCATION: COUNTER	COVIDIEN 8990SA W/8974 8974/8990SA	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: STORAGE
ROOM #: 3.2.3138

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
SHLCR-058 	1	SHELVING, WIRE, CHROME, 36 SHELVES ADJUST IN 1" INCREMENTS. NSF CERTIFIED. OPTIONAL 5" POLYURETHANE SWIVEL STEM CASTERS ADD 6" TO HEIGHT. ADD-ON UNITS AND WI... WxDxH: 36.00 IN x 12.00 IN x 54.00 IN WEIGHT: 38.00 LB LOCATION: FLOOR	ULINE CHROME WIRE SHELVING UNIT - 36 X 12 X 54" H-2936-54	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
MAYSL-017 	1	STAND, MAYO, SCREW-LOCK-OPERATED BRAND ENTRUST PERFORMANCE MANUFACTURER MCKESSON BRAND APPLICATION INSTRUMENT STAND BASE. FIVE LEG BASE CASTER WxDxH: 21.50 IN x 21.50 IN x * WEIGHT: 7.15 LB LOCATION: MOBILE	MCKESSON ENTRUST PERFORMANCE MOBILE INSTRUMENT STAND 81-43465	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
WDPHC-013 	1	WASTE DISPOSAL, PHARMACEUTICAL, CONTAINER PHARMACEUTICAL HAZARDOUS WASTE CONTAINER WxDxH: 19.00 IN x 12.25 IN x 25.50 IN WEIGHT: NAN LOCATION: FLOOR	STERICYCLE 18 GALLON COVIDIEN RCRA CONTAINER 8618RC	EXISTING RESP: OF/OI GROUP: N/A



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: STORAGE
ROOM #: 3.2.3138

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
WCRAS-044	1	WHEELCHAIR, ADULT, STANDARD POWDER-COATED SILVER VEIN STEEL FRAME. EMBOSSED VINYL UPHOLSTERY. URETHANE TIRES MOUNTED ON COMPOSITE WHEELS. 8" FRONT CASTERS, AD...	DEVILBISS HEALTHCARE SILVER SPORT 2 (18IN./FIXED ARM/SWING AWAY FR) SSP218FA-SF	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT



END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: APP
ROOM #: 3.2.3139

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
	0	NONE, NO EQUIPMENT		
		WxDxH: x x		
		WEIGHT:		RESP: 0F/0I
		LOCATION:		GROUP:
END OF ROOM				



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: OFFICE (QTY 4)
ROOM #: 3.2.3141, 3.2.3143, 3.2.3144, 3.2.3145

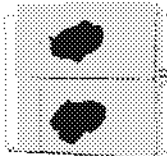
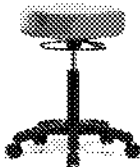
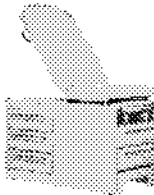
CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 WSTOT-005	4	WASTE CAN, OPEN TOP 28-QUART (7-GALLON) OPEN TOP WASTEBASKET WITH ROUNDED CORNERS. FIBERGLASS, FIRE-RESISTANT. GRAY TEXTURED FINISH. UL CLASSIFICATION... WxDxH: 10.50 IN x 14.50 IN x 15.30 IN WEIGHT: * LOCATION: FLOOR	RUBBERMAID COMMERCIAL PRODUCTS 2543 FIRE RESISTANT GRAY (28 QT.) FG254300GRAY	NEW RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: DEVICE
ROOM #: 3.2.3142

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
 GLVDB-025	1	DISPENSER, GLOVE, DOUBLE BOX GLOVE BOX DISPENSER - DOUBLE HOLDS TWO BOXES OF GLOVES HORIZONTALLY KEYHOLES FOR VERTICAL WALL MOUNTING CLEAR PETG PLASTIC MADE IN... WxDxH: 3.70 IN x 11.20 IN x 9.60 IN WEIGHT: 1.20 LB LOCATION: WALL	BOWMAN DISPENSERS GLOVE BOX DISPENSER - DOUBLE GP-320	NEW RESP: OF/CI GROUP: 1-FIXED
 STLEC-190	1	STOOL, EXAM, CUSHION-SEAT VINYL; 3" FOAM; DESK HEIGHT; BLACK DUAL WHEEL CASTERS; 250 LB CAPACITY; HEIGHT ADJUSTABLE;14.75" SEAT DIAMETER; SPECIFY COLOR WxDxH: 21.00 IN x 21.00 IN x 23.00 IN WEIGHT: LOCATION: MOBILE	SOURCE MEDICAL PERCH LIFE LFLN	EXISTING RESP: OF/OI GROUP: 3-MOVABLE, NON-ELECT
 TBLMA-148	1	TABLE, EXAM/TREATMENT, MANUAL ADJUST MANUAL EXAM TABLE WITH PNEUMATIC-ASSIST BACK HAVE A 500LB WEIGHT CAPACITY, AND REVERSIBLE SIDE AND FRONT STORAGE DRAWERS (5 DRAWER... WxDxH: 28.00 IN x 74.50 IN x 32.75 IN WEIGHT: 241.00 LB LOCATION: FLOOR	UMF MEDICAL 5250 5250	NEW RESP: OF/OI GROUP: 2-MOVABLE, ELECT



OLOL ST. ELIZABETH MOB 3 (2505)
EQUIPMENT REPORT BY DEPARTMENT

FLOOR:
DEPARTMENT: 2) CARDIOLOGY CLINIC
ROOM NAME: DEVICE
ROOM #: 3.2.3142

CATALOG ID ITEM ID	QTY	DESCRIPTION	MANUFACTURER MODEL MANUFACTURER CATALOG #	STATUS
WSTST-059	1	WASTE CAN, SWING TOP	SIMPLE HUMAN LLC	EXISTING
		BLACK; 16 GALLON; RECTANGULAR; PLASTIC	CW1333	
		WxDxH: 13.25 IN x 16.75 IN x 32.75 IN	CW1333	
		WEIGHT:		RESP: OF/OI
		LOCATION: N/A		GROUP: 3-MOVABLE, NON-ELECT

END OF ROOM

SECTION 122400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manual roller shades and accessories.

1.02 REFERENCE STANDARDS

- A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.
- B. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

- A. See Section 013000, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product to be used including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Verification Samples: Minimum size 2" square, representing actual materials, color and pattern.
- D. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 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.

1.06 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

- A. See Section 017000 – Closeout Requirements, for additional warranty requirements.
- B. Provide manufacturer's standard, non-depreciating warranty, for interior shading only, covering the following:
 - 1. Shade Hardware: 10 years unless otherwise indicated.
 - 2. Shade Fabric: 10 years unless otherwise indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: MechoShade Systems LLC: www.mechoshade.com

2.02 ROLLER SHADES

A. General:

1. Provide shade system components that are capable of being removed or adjusted without removing mounted shade brackets or cassette support channel.
2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Basis of Design - Roller Shades: MechoShade Systems LLC; Mecho/5

System: www.mechoshade.com/#sle.

1. Description: Single roller, manually operated fabric window shades.
 - a. Drop Position: Regular roll.
 - b. Mounting: Inside window jam at the ceiling and overlap mullions to prevent light leakage.
 - c. Size: Measure existing windows on-site.
 - d. Fabric: Soho
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch (3 mm) thick.
3. Roller Tubes:
 - a. Material: Extruded aluminum.
 - 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. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
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. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - a. Provide a permanently lubricated brake assembly mounted on a oil-impregnated hub with wrapped spring clutch.
 - b. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.

- c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
- 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound (43 kg) minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
- 7. Accessories:
 - a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; submit full line of options to Architect for approval.
 - 1) Fascia to be capable of installation across two or more shade bands in one piece.
 - 2) Profile: Square.

2.03 SHADE FABRIC

- A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - 1. Performance Requirements:
 - a. Flammability: Pass NFPA 701 large or small scale test.
 - 2. Openness Factor: 1%, nominal.
 - 3. Color: As indicated on drawings.
 - 4. Products:
 - a. MechoShade Systems LLC Inc; Soho - 1100 Series (1% open): www.mechoshade.com

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. 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 CLOSEOUT ACTIVITIES

3.06 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 064116 Plastic Laminate-Faced Architectural Cabinets

1.03 REFERENCE STANDARDS

- A. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- C. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- D. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.05 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.

1.06 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 - 2. 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. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - b. Color and Pattern: As indicated on drawings.

3. Other Components Thickness: 1/2 inch (12 mm), minimum.

2.02 MATERIALS

- A. Wood-Based Components:
 1. Wood fabricated from old growth timber is not permitted.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 ACCESSORIES

- A. Fixed Top-Mounted Countertop Support Brackets:
 1. Material: Steel.
 2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
 3. Color: As indicated on drawings.

2.04 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 (25 mm) 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. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

3.02 CLEANING

- A. Clean countertops surfaces thoroughly.

3.03 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 142123 - ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Electric traction passenger elevators.

1.02 RELATED SECTIONS

- A. Section 015000 - Facilities and Controls
- B. Section 042223 - Architectural Concrete Unit Masonry
- C. Section 051200 - Structural Steel Framing
- D. Section 061000 - Rough Carpentry
- E. Section 092116 - Gypsum Board Assemblies
- F. Section 099000 - Paints and Coatings
- G. Section 283111 - Digital Addressable Fire Alarm
- H. Section 230000 - HVAC General Requirements
- I. Section 260500 - Common Work Results for Electrical
- J. Section 262416 - Panelboards
- K. Section 265100 - Interior Lighting
- L. Section 271000 - Communications Cabling

1.03 REFERENCES

- A. ANSI/ASME A17.1/CAN/CSA B44 – Safety Code for Elevators and Escalators.
- B. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
- C. ANSI/NFPA 70 – National Electrical Code.
- D. ANSI/NFPA 80 – Fire Doors and Windows.
- E. ANSI/UL 10B – Fire Tests of Door Assemblies.

1.04 DESIGN REQUIREMENTS

A. Arrange elevator components in control closet or machinery space so equipment can be removed for repairs or replaced with minimal disturbance to other equipment and components.

B. Where permitted by code, provide all elevator equipment including controls, drives, transformers, and rescue features within the elevator hoistway.

1.05 SUBMITTALS

- A. Comply with Section 013000 - Administrative Requirements

- B. Product Data: Submit manufacturer/installer's product data, including,

- a. Descriptive brochures or detail drawings of car and hall fixtures, cab ceilings, and product features.

- b. Power Information: Horsepower, starting current, running current, machine and control heat release, and electrical requirements.

- C. Shop Drawings: Submit manufacturer/installer's shop drawings, including plans, elevations, sections, and details, indicating location of equipment, loads, dimensions, tolerances, materials,

components, fabrication, fasteners, hardware, finish, options, accessories, and other information to render totally functional elevators.

D. Samples: Submit manufacturer/installer's samples of standard colors and finishes of finish materials.

E. Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.

F. Warranty: Submit manufacturer/installer's standard warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer/Installer's Qualifications: Specialize in manufacturing and installing elevator equipment, with a minimum of 10 years successful experience.

B. Regulatory Requirements:

a. Elevator design, clearances, construction, workmanship, materials, and installation, unless specified otherwise, shall be in accordance with ANSI/ASME A17.1, handicap accessibility, Americans with Disabilities Act, and other codes having legal jurisdiction.

b. ANSI/ASME A17.1 shall govern, except where codes having legal jurisdiction include more rigid requirements or conflict with ANSI/ASME A17.1.

c. Elevator shall follow design and manufacturing procedures certified in accordance with ISO 9001-2000 to meet product and service requirements for quality assurance for new products.

d. Where product is in variance to the published ANSI/ASME A17.1 model code, provide a 3rd party AECO certification demonstrating equivalent function, safety, and performance.

C. Pre-installation Meeting:

a. Convene pre-installation meeting before start of installation of elevators.

b. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and elevator manufacturer/installer.

c. Review examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer/installer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer/installer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer/installer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.08 PROJECT CONDITIONS

A. Temporary Electrical Power:

a. Owner will arrange for temporary 220 VAC, single-phase, 60 Hz., GFCI-protected electricity to be available for installation of elevator components.

b. Comply with Section 015000 – Temporary Facilities and Controls

B. Installation of the Elevator:

- a. General Contractor will provide permanent three-phase power prior to installation start.
 - b. General Contractor will provide clear, rollable access to a 20' x 10' secure and dry storage area prior to delivery.
 - c. General Contractor will provide a clean, dry, and complete hoistway along with temporary installation platform and all required OSHA-compliant barricades prior to delivery.
- C. Temporary Use of Elevator:
- a. Owner will negotiate with manufacturer/installer for temporary use of elevator, if required.
 - b. Temporary use of elevator shall be in accordance with terms and conditions of manufacturer/installer's temporary acceptance form.

1.09 SCHEDULING

- A. Coordinate elevator work with work of other trades, for proper time and sequence to avoid construction delays.

1.10 WARRANTY

- A. Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop within 1 year after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

1.11 MAINTENANCE SERVICE

- A. Elevator maintenance service shall be performed by elevator manufacturer/installer.
- B. Elevators shall receive regular maintenance on each unit for period of 12 months after completion of work specified herein or acceptance thereof by beneficial use, whichever is earlier.
- C. Trained employees shall make periodic examinations and perform work including necessary adjusting, greasing, oiling, and replacing parts to keep elevators in operation, except parts that require replacement because of accidents, vandalism, misuse, or negligence by parties other than manufacturer/installer.
- D. Manufacturer/installer shall perform all Work, except emergency minor adjustment call-back service, during regular working hours. Manufacturer/installer shall provide emergency minor adjustment call-back service, during regular working hours.
- E. Should Owner request that examinations, cleaning, lubrication, adjustments, repairs, replacements, or emergency minor adjustment call-back service, unless specified herein, be performed on other than manufacturer/installer's regular working hours of regular working days, manufacturer/installer shall absorb straight-time labor charges and Owner will compensate manufacturer/installer for overtime premium, travel time, and expense at normal billing rates.
- F. Elevator Control System:
- a. Include built-in remote diagnostic module to relay constant status of elevators and control system to a 24-hour, 7-days-a-week central-monitoring facility.
 - b. Remote Monitoring Device: Transmit information on current status of elevators, including malfunctions, system errors, and shutdown.

PART 2 – PRODUCTS

2.01 MANUFACTURER/INSTALLER

A. Schindler Elevator Corporation, Website www.us.schindler.com.

B. Elevator shall be installed by elevator manufacturer.

2.2 ELEVATOR SYSTEM AND COMPONENTS

A. Electric Traction Passenger Elevators: Basis of design is the Schindler 3100 Gearless Traction Elevator.

B. Elevator Equipment Summary:

a. Application: Machine Room Less (MRL)

b. Counterweight Location: Side

c. Machine Location: Top of the hoistway mounted on car and counterweight guide rails

d. Control Space Location: Top landing entrance frame or entrance frame at one floor below the top landing

e. Service: General Purpose Passenger

f. Quantity: 1 Unit

g. Capacity: 3500 lbs

h. Speed: 100 fpm

i. Travel: 34' 0"

j. Landings: 3

k. Front Openings: 3

l. Rear Openings: 0

m. Rear Door Hand: N/A

n. Operation: Microprocessor Single Car Automatic Operation

p. Clear Inside Dimensions: 6' 9-5/16" Wide X 5' 6-7/8" Deep

q. Cab Height: 7' 9"

r. Guide Rails: Equivalent to 12 lb. per foot

s. Entrance Type and Width: Two Speed Side Opening 3' 6" Wide X 7' 0" High doors

t. Entrance Height: 7'-0"

u. Power Supply: 600 Volts 3 Phase 60 Hz

C. Performance:

a. Car Speed: -10% to +5% of contract speed under any loading condition or direction of travel.

b. Car Capacity: Safely lower, stop and hold up to 125% of rated load per code.

D. Ride Quality:

a. Vertical Vibration (maximum): 25 mg

b. Horizontal Vibration (maximum): 15 mg

c. Vertical Jerk (maximum): 2 ft/sec³

d. Acceleration (maximum): 1.6 ft/sec²

e. In Car Noise: 53-60 dB(A)

- f. Stopping Accuracy: $\pm 5\text{mm}$
- g. Starts per hour (maximum): 180

E. Elevator Operation:

a. Simplex Collective Operation: Using a microprocessor based controller, operation shall be automatic by means of the car and hall buttons. When all calls have been answered, the car shall park at the last landing served.

b. Group Automatic Operation with Demand-Based Dispatching: Provide reprogrammable group automatic system that assigns cars to hall calls based on a dispatching algorithm designed to minimize passenger waiting time.

F. Operating Features - Standard:

- a. Door Light Curtain Protection
- b. Static AC Drive
- c. Phase Monitor Relay
- d. Cab Overload with Indicator
- e. Load-weighing
- f. Central Alarm
- g. Remote Monitoring
- h. Firefighter's Operation
- i. Automatic Evacuation

l. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. If the car is at a floor when the power fails, it remains at that floor, opens its doors, and shuts down. If the car is between floors, it is raised or lowered to the first available landing, opens its doors, and shuts down.

- j. Independent Service

G. Operating Features - Optional:

2.03 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microprocessor based control system to perform all of the functions of safe elevator operation, as well as perform car and group operational control.

a. All high voltage (110v or above) contact points inside the inspection and test panel shall be protected from accidental contact in a situation where the access panels are open.

b. The controller shall be distributed throughout the elevator system located in the overhead, cab and inspection and test panel. The inverter will be mounted in the overhead adjacent to the hoist machine and an inspection and test panel will be located in the door jamb at the top floor or one floor below the top floor. No elevator equipment mechanical rooms or closets are required.

- c. Provide multi-bus control architecture to reduce cabling, material and waste.

B. Drive: Provide a Variable Voltage Variable Frequency AC Closed Loop drive system. Provide stable start without high peak current, quickly reaching a low energy consumption level.

C. Inspection and Test Panel: Integrated control equipment, main inspection and test panel in door frame at top level served or at one floor below the top level served.

2.04 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine:

- a. Gearless asynchronous AC motor with integral drive sheave, service and emergency brakes.
- b. Design machine to enable direct power transfer, thereby avoiding loss of power.
- c. Design machine to be compact, lightweight and durable to optimize material usage and save space.
- d. Mount to structural support channels on top of guide rail system as applicable in hoistway overhead.

B. Governor:

- a. Tension type over-speed governor with remote manual reset.
- b. Mount to structural support channels as applicable in hoistway overhead.

C. Buffers, Car and Counterweight: Compression spring type buffers to meet code.

D. Hoistway Operating Devices:

- a. Emergency Stop switch in the pit.
- b. Terminal stopping switches.
- c. Emergency stop switch on the machine.

E. Positioning System: System consisting of proximity sensors and door zone vanes.

F. Guide Rails and Attachments: Provide Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Suspension System: Non circular Elastomeric coated suspension media with high tensile grade steel cords.

H. Governor rope: Steel wire rope with 6 mm diameter.

2.05 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Doors and Frames:

- a. UL rated with required fire rating.
- b. Doors: Rigid flush panel construction with reinforcement ribs.
- c. Frames: Securely fasten at corners to form unit frame. Frames shall be bolted.

B. Finish:

- a. Exposed Areas of Corridor Frames: Painted Primer - All Floors
- b. Exposed Areas of Corridor Frames: Painted Primer - All Floors
- c. Exposed Areas of Corridor Frames:
 - I. 1st Floor: Painted Primer
 - II. 2nd Floor: Painted Primer
 - III. Typical Floors: Painted Primer
- d. Doors: Painted Primer - All Floors
- e. Doors: Painted Primer - All Floors
- f. Doors:
 - I. 1st Floor: Painted Primer

II. 2nd Floor: Painted Primer

III. Typical Floor: Painted Primer

g. Sills: Aluminum - All Floors

C. Entrance Markings and Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.06 EQUIPMENT: CAR COMPONENTS

A. Car Frame and Safety: Provide car frame with adequate bracing to support the platform and car enclosure. The safety shall be integral to the car frame and shall be flexible guide clamp type.

B. Platform: Provide platform of steel construction with plywood subfloor and aluminum threshold.

C. Car Guides: Provide sliding guide shoes mounted to top and bottom of both car and counterweight frame. Arrange each guide shoe assembly to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Provide central guiding system to reduce mechanical friction and energy consumption.

E. Steel Cab:

a. Fire rating: Provide Class B fire rating for cab, or Class A fire rating where required by local Code.

b. Design cab to comply with LEED Indoor Environmental Quality requirements through use of Low-Emitting Materials on walls, ceiling and subflooring.

c. Car wall finish: Painted Primer selected from manufacturer's standard selections.

d. Base and frieze: Aluminum.

e. Car front finish: Brushed stainless steel.

f. Car door finish: Brushed stainless steel.

g. Ceiling: Canopy ceiling, finished in #4 Stainless Steel With Down Lit Led Lighting. Provide lighting consisting of four compact fluorescent energy saving lights located in two semi-oval lateral cutouts located on the center-sides of the cab ceiling, Lexan lens cover.

h. Handrail: 1 3/8" Round And Curved Painted Aluminum. Locate on Rear Wall.

i. Flooring: By others. Not to exceed 3/8" finished depth.

j. Ventilation: Provide one-speed fan in canopy.

k. Emergency Car Lighting: Provide an emergency power unit employing a 12 volt sealed rechargeable battery and static circuits to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

l. Emergency Siren: Provide siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged.

m. Emergency Exit Switch: Provide an electrical contact to open the safety circuit when the emergency car top exit is opened. When the exit door is opened, the top exit switch shall signal the control and the car will be unable to move.

n. Emergency Exit Lock: Provide an emergency exit lock where required by local code.

o. Emergency Exit Guard: Provide emergency exit guard on top of car when required for hoistway wall to platform clearance exceeds 12" or for multiple cars in hoistway.

2.07 DOOR OPERATOR AND REOPENING DEVICES

A. Door Operator: Provide a closed loop VVVF high performance door operator with frequency controlled drive for fast and reliable operation to open and close the car and hoistway doors simultaneously.

B. In case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Provide emergency devices and keys for opening doors from the landing as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. Provide door open button in the car operating panel. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Provide door hangers and tracks for each car and hoistway door. Contour tracks to match the hanger sheaves. Design hangers for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed for life bearings.

E. Electronic Door Safety Device: Equip car doors with concealed transmitter and receiver infrared beam devices to detect presence of object in process of passing through hoistway entrance and car doorway (light curtain device).

a. Use multi-beam scanning without moving parts to detect obstructions in door opening.

b. Detector Device: Prevent doors from closing, or if they have already started closing, cause doors to reopen and remain open while object is within detection zone.

c. Horizontal Beams: Minimum of 33 infra red beams to fill doorway from ground level to a height of 6 feet.

2.08 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide a car operating panel with all push buttons, key switches and message indicators for elevator operation.

a. Full height car operating panel shall be surface-mounted on front return.

b. Comply with handicap requirements.

c. Push Buttons: Mechanical, illuminating using long-lasting LEDs for each floor served.

d. Emergency Buttons: Provide in accordance with code. Emergency alarm button, door open and door close buttons.

B. Features of the Car Operating Panel Shall Include:

a. Audible chime to signal that the car is either stopping at or passing a floor served by the elevator.

b. Raised markings and Braille provided to the left hand side of each push button.

c. Car Lantern: Provide LED illuminated car lantern with direction arrows to comply with local code when hall lanterns are not provided.

d. Door open and close push buttons.

e. Firefighter's hat and Phase 2 Key-switch

f. Inspection key-switch.

g. Key-switch for optional Independent Service Operation

h. Illuminated alarm button with raised marking.

i. Elevator Data Plate marked with elevator capacity and car number.

j. Help Button: Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

C. Hall Fixtures: Provide hall fixtures with necessary push buttons and key switches for elevator operation.

a. Push buttons: Metallic tactile push buttons, up button and down button at intermediate floors, single button at each terminal floor.

b. Height: Comply with handicap requirements.

c. Illumination: Illuminating using long-lasting low power LEDs.

D. Hall Lanterns and Position Indicators.

a. LED illuminated direction arrows with audible and visible call acknowledgement.

E. Hoistway access switches: Provide key-switch at top and/or bottom floor in entrance jamb as required by local code.

F. Firefighter's Phase 1 Service: Key switch in brushed stainless steel cover plate.

G. Fixture Cover Plates: For push buttons, hall lanterns and position indicators, resistant white back-printed glass, no screws required for mounting. Provide stainless steel cover plates for Firefighter's Phase I switch and hoistway access switches, with tamper resistant screws in same finish.

H. Mounting: Mount hall fixtures in entrance frames.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine hoistways, hoistway openings, and pits before starting elevator installation.

B. Verify hoistway, pit, overhead, and openings are of correct size, within tolerances, and are ready for work of this section.

C. Verify walls are plumb where openings occur and ready for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

D. Verify hoistway is clear and plumb, with variations not to exceed -0 to +1 inch at any point. Verify projections greater than 4" must be beveled not less than 75 degrees from horizontal. No negative tolerance is permitted for minimum hoistway dimensions.

E. Verify minimum 2-hour fire-resistance rating of hatch walls.

F. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of elevators.

G. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer/installer.

3.02 INSTALLATION

- A. Install elevators in accordance with manufacturer/installer's instructions and ANSI/ASME A17.1.
- B. Set entrances in vertical alignment with car openings, and aligned with plumb hoistway lines.

3.03 FIELD QUALITY CONTROL

- A. Perform tests of elevator as required by ANSI/ASME A17.1 and governing codes.

3.04 ADJUSTING

- A. Adjust elevators for proper operation in accordance with manufacturer/installer's instructions.
- B. Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.
- C. Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in leveling zone and stopping at that landing.
- D. Adjust automatic floor leveling feature at each floor to within 1/4 inch of landing.
- E. Repair minor damages to finish in accordance with manufacturer/installer's instructions and as approved by Architect.
- F. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.05 CLEANING

- A. Clean elevators promptly after installation in accordance with manufacturer/installer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.06 PROTECTION

- A. Protect installed elevators from damage during construction in accordance with the negotiated temporary use agreement between Owner and manufacturer's installer.

END OF SECTION

SECTION 210000 - FIRE SUPPRESSION GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

- A. These Specifications are intended to provide complete and in proper operation all equipment and materials necessary for a fire suppression system, all as specified herein or shown on the accompanying Drawings, or reasonably implied in either, and including roughing-in services and connections for equipment furnished under other contracts or by the Owner, unless shown otherwise. The term "Contractor" as used in this section of these Specifications shall denote the Fire Suppression Sub-Contractor.
- B. All electrical work, associated with the fire suppression system, shall be done under the Electrical Section of these Specifications, except where indicated. See DIVISION 26 - ELECTRICAL for coordination. Furnish wiring diagrams and any other information required for all wiring in connection with Fire Suppression Equipment and Controls.
- C. Painting, except for special coats as herein specified, is included in other sections of the Specifications, (see DIVISION 09 - FINISHES). The Contractor shall coordinate and inform Division 09 Tradesman for the painting of all non-insulated or coated piping, support steel and fittings including valves. This piping shall include steel piping, supports, valves, flanges and hangers. It does not include cast iron or plastic or copper piping. It shall include touch up on welding for equipment having factory finishes. It is intended that all piping not insulated or manufacturer pre-coated (galvanized, for example) and all other metals furnished and installed under this subcontract that are subject to rusting or discoloration shall be painted. Before finished coat of painting is applied, items outdoors and indoors shall have a base coat of cold galvanizing compound or industrial grade rust inhibiting primer (compatible with final coating).
- D. Generally sprinkler piping is to be installed concealed to view, above finished ceilings and/or behind finished wall surfaces. However, when piping must be installed exposed to view within spaces which have finished ceiling and/or wall systems, piping is to be installed a neat manner and shall be painted to match the color of the ceiling and/or wall finish, as directed by the Architect. See SECTION 210010 - PIPE COLOR CODING for color coding of fire suppression items.
- E. The Contractor shall verify all utility tie-in points for exact location, elevation and size and shall verify all routings and determine any interference with existing obstructions or obstructions that might result from other work in this project. Contractor shall closely coordinate with all trades before beginning any work. Contractor shall be aware of all specialty ceilings and other specialty finishes and coordinate with Architect so as not to interfere with design intent and finish of these areas. Any equipment or piping installed prior to coordination shall be subject to removal and relocation at no cost to the Owner. Fire suppression piping shall take least precedence in areas requiring close coordination with other trades.

1.02 GENERAL CONDITIONS

- A. The Instructions to Bidders, General Conditions, Special and Supplementary Conditions, all contained in DIVISION 01 - GENERAL REQUIREMENTS, shall be part of this section of the

Specifications the same as if attached hereto. The Contractor shall read and be thoroughly familiar with all provisions of DIVISION 01.

- B. It shall be understood that these Specifications and the accompanying Drawings, contemplate complete apparatus, fully erected and in successful operating condition. All work shall be performed in the best and most substantial manner.

1.03 MANUFACTURERS OR TRADE NAMES

- A. Where the Drawings and Specifications mention the products of specific manufacturers, it is intended that the Contractor shall furnish the items as specified, or a substitute listed by addendum to the Specifications. Request for substitution shall be made in writing at least seven working days before bids are taken unless required otherwise in the Architectural Specifications. Requests shall include all materials necessary and exact model numbers proposed for the Professional of Record to fully evaluate the substitution or they will not be considered for review. Request shall also show (highlight, underline, etc.) where the substitution is compliant with the Specifications and any deviations from the Specifications or they will be rejected. The burden of equivalency shall be on the Contractor.

1.04 ORDINANCES, RULES AND REGULATIONS

- A. All material and construction shall conform to the requirements of all building codes, sanitary codes and laws and ordinances currently enforced in the locality in which the work shall be done. All materials and construction shall also conform to the rules and regulations of the National Fire Protection Association, Underwriter's Laboratories and National Electrical Manufacturers' Association.

1.05 PERMITS, FEES AND INSPECTIONS

- A. Contractor shall obtain all permits and inspections required in connection with this work and shall pay any fees or other costs involved. Inspections shall be for fire suppression systems as required by State and/or Local Regulating Authorities for the system to be installed. Unless indicated otherwise, Contractor shall coordinate with the various companies and pay fees required for utility service connections and meters for fire suppression water systems.

1.06 GUARANTEE

- A. The Contractor shall guarantee all materials and workmanship under this contract for a period of one year from date of final acceptance, as defined by the Architect, of his work and shall repair and replace any such defective materials and workmanship without cost to the Owner.
- B. The Contractor shall guarantee to all equipment be of the quality and capacity specified.

1.07 WARRANTIES

- A. Refer to DIVISION 01 - GENERAL REQUIREMENTS for procedures and submittal requirements for warranties. Refer to individual equipment specifications for specific warranty requirements. Compile and assemble the warranties specified in the "FIRE SUPPRESSION WORK" into a separated set of vinyl covered and suitable three ring type permanent binders, tabulated and indexed for easy reference. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond,

duration of warranty or bond, names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

1.08 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide three copies of typewritten system operating instructions and three copies of operating and maintenance brochures for each piece of equipment including manufacturer's descriptive bulletins with wiring diagrams, parts lists and specific lubricating and maintenance instructions. Brochures shall be bound in suitable vinyl covered, three ring type permanent binders, tabulated and suitably indexed.
- B. In addition, provide a digital copy of all operating instructions and operating and maintenance brochures (in PDF format) all as specified above.

PART 2 - PRODUCTS

No products are specified under this section of the Specifications.

PART 3 - EXECUTION

3.01 REVIEW OF EQUIPMENT AND MATERIALS

- A. Within fifteen days of award of the contract, the Contractor shall submit a digital copy (PDF format) of manufacturers' data and descriptive literature and drawings for all equipment and materials. All literature and data on all equipment shall be submitted at the same time: this material shall contain complete capacity data, curves, dimensions and all other pertinent information necessary for the Architect to properly evaluate the item. No item of equipment or material shall be placed on order until Final Review comments are received from the Architect. In the event the Contractor submits equipment requiring revisions to others work, including but not limited to electrical service or structural supports, other than that shown in the Drawings and Specifications, the Contractor shall bear all costs of the necessary revisions.
- B. Refer to SECTION 210040 - SHOP DRAWINGS AND SUBMITTAL DATA for additional requirements.

3.02 COORDINATION OF TRADES

- A. Where work is in close proximity to the work of other contractors, the Contractor shall review plans of other contractors and coordinate his work with theirs. The Contractor shall verify the location of lighting fixtures, beams, conduit, pipes, ductwork and other obstructions before beginning his work in the area. Notify the Architect where proper clearances do not occur or where the work of others would interfere with the safe and/or proper operation of this work. Fire suppression piping shall take least precedence over other equipment such as ductwork, lighting fixtures, etc.

3.03 START-UP AND INSTRUCTIONS

- A. The Contractor shall furnish qualified personnel to start-up the installation and to train the Owner's operator in operation of the system.

3.04 SITE CONDITIONS

- A. The Contractor shall visit the building site to determine existing conditions and shall be held responsible for allowing for these conditions in his bid. This will include above or below grade items that may affect the work.

3.05 EXISTING BUILDING CONDITIONS

- A. Note that this area of work has existing storm drainage, mechanical and electrical utilities located underground and within and under the building. It is part of this work for the Contractor to determine the scope and location of all existing utilities and the scope and location of all new utilities to be installed concurrent with this project and to arrange his work around others.
- B. Contractor shall not excavate or demolish without first ascertaining the location of underground public utilities by serving telephonic notice to a regional notification program. In the State of Louisiana, the regional notification program is Louisiana One Call.
- C. Contractor shall inspect all existing conditions and space limitations at the site and shall include in his bid all required special adjustments because of site conditions. Verify conditions during construction before fabrication of system components. Early fabrication will not be justification for extra payments for changes due to job conditions.

3.06 SALVAGEABLE MATERIALS

- A. The Owner shall have priority for the selection of the salvageable materials and equipment from the building. Any equipment and materials selected to remain the property of the Owner shall be removed and delivered to a location on the building site as designated by the Architect. All other materials shall be legally and properly disposed of. Provide written documentation, receipts and information indicating the materials, disposal site and date.

3.07 SHUT DOWN OF EXISTING SERVICES

- A. Where existing fire suppression systems are to remain operational during construction, all interruptions of such systems shall be held to a minimum. Coordinate outages using a written request to the Architect through the General Contractor. Request shall be submitted to the Architect at least 72 hours prior to outage time requested.
- B. Contractor shall provide a fire watch for areas not protected by the fire suppression system, during outages. Contractor shall visit the site, prior to bid, to determine fire suppression valve locations and the extend of the area affected, by required shut downs, to allow for the cost of the fire watch in his bid.

END OF SECTION

SECTION 210010 - FIRE SUPPRESSION BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 LABELS

- A. Provide a label on each piece of apparatus and each controlling device. Labels shall identify item and number and have identifying function and position settings. Labels shall be pressure sensitive adhesive mount type, 1/16 inch minimum thickness, engraved type laminated plastic, black with white lettering.

1.02 PIPING IDENTIFICATION

- A. Provide markers on piping which is either exposed or concealed in accessible spaces, with Seton Setmark, EMED Co. Kwik Koil, or equal plastic snap-around markers. For insulated piping, markers may be Seton Opti-Code, EMED Co. Econo Mark pressure sensitive vinyl markers with matching self-adhesive "arrow" banding tape applied circumferentially at each end of marker. For piping system, other than drain and vent lines, include generic name of system or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50 feet maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required. Markers shall comply with ANSI A13.1 Standard.

1.03 PIPE COLOR CODING

- A. Except where noted otherwise (see below), pipe colors shall be ANSI Standards Red, Blue, Green, Yellow or Aluminum according to function. Piping supports shall be painted, see SECTION 210000, paragraph 1.1 SCOPE.
- B. Except for piping concealed above ceilings or concealed within wall/chase space, piping shall have the following color coding:
 - 1. Fire Protection System Piping (exposed within Stairwells): Red - field painting
- C. Where "Field Painting" is indicated, refer to Division 09 - FINISHES for color code painting of piping. Verify, with Architect, color code requirements prior to installation of jacketing and prior to field painting.

1.04 MATERIALS IN AIR DUCTS AND PLENUMS

- A. No plastic or other non-metallic materials as defined by NFPA 90A shall be used in air ducts or plenums unless specifically rated for such service.

PART 2 - PRODUCTS

2.01 MOTORS

- A. Electric motors with characteristics as shown on the Drawings shall be provided by the Contractor for all pieces of driven equipment. Electric motors shall be submitted for approval and shall conform to the following: Single phase motors shall generally be as recommended

by the manufacturer of the driven equipment. Three phase motors shall be squirrel-cage induction type motors unless otherwise specified. Motors shall have characteristics as listed on the Drawings and shall be selected to be non-overloading and capable of normal scheduled operation without requiring operating in the service factor range. Motors shall be designed for a 40°C rise from 40°C ambient and shall have NEMA design B normal starting torque unless otherwise specified. Enclosures shall be open, drip-proof for all applications not exposed to outside weather conditions and totally enclosed, fan-cooled for motors located outside, or exposed to outside conditions. All motors shall be rated at full load conditions and be high efficiency, high power factor type, copper wound, premium grade, and shall comply with the Louisiana Building Energy Conservation Code and based on ASHRAE 90.1-2007 with all addenda. Motor shall comply with Energy Independence and Security Act (EISA) of 2007 (NEMA MG-1 Tables 12-1 and 12-2).

- B. In addition, motors for inverter, variable frequency drive use shall be definite purpose inverter fed motor rated NEMA MG-1, Part 31 compliant and rated to withstand voltage peaks of 1600 volts at a rise time of 0.1 microseconds as a minimum.

PART 3 - EXECUTION

3.01 SUPPORTS, FOUNDATIONS AND VIBRATION ISOLATION

- A. The Contractor shall, unless otherwise specified, provide all foundations, supports, etc., necessary for properly supporting his work and equipment furnished by him and shall furnish and install all isolation materials to prevent transmission of vibration to the building structure. Isolation of equipment, as shown on Drawings, is the minimum required and any additional isolation required to prevent transmission of vibration or sound shall be provided by the Contractor, in accordance with the equipment manufacturer's requirements. All floor mounted equipment shall have a 4 inch high minimum housekeeping concrete pad with 1 inch chamfered edges. For indoor slab mounted equipment, vibration isolation is required for all vibrating or rotating equipment.
- B. Where applicable, under no circumstances shall the Contractor to attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems shall be approved by the Architect. All supplemental angle or channel iron required to support equipment of this Specification shall be furnished by the Contractor and shall be independent of any other supports.
- C. Supports for piping, conduit and equipment exceeding 200 pound load suspended from overhead construction in concrete shall incorporate steel imbedded anchors into the concrete pour. Use stainless steel expansion anchors only for loads less than 200 pounds per anchor and only in non-post tensioned slabs. For post tensioned slabs use imbedded support plates only.
- D. For slab mounted equipment, provide rubber mounting pads at each corner and under the support rails. For suspended units, provide combination rubber and captured spring isolators at each suspension point under the support base. Size and configuration shall be as required by the manufacturer for the use intended.
- E. Base-mounted or pad-mounted equipment specified herein or in the Drawings shall be installed at an elevation that is greater than or equal to the building's top of slab elevation, but in no case less than 1'-0" above the Base Flood Elevation (BFE) as designated by the Flood Insurance Rate Map (FIRM) for the geographical location of the project site.

3.02 OPENINGS, CUTTING AND PATCHING

- A. Cut all openings as required for the work under this subcontract. Patching shall be done by the various crafts whose work is involved. Furnish and install all necessary sleeves, thimbles, hangers, inserts, etc., at such times and in such a manner as not to delay or interfere with the work of other contractors. Seal, caulk and otherwise make air tight all pipe penetrations through walls and floors. Caulk, flash or otherwise make weatherproof all penetrations through the roof and exterior walls. No pipe opening shall be sealed around the pipe or insulation without the penetration isolated from the wall system.
- B. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- C. For all openings larger than 16 inches horizontal dimension in existing masonry walls, provide 3 inch x 6 inch x 1/4 inch steel angle lintel with 8 inch minimum bearing length extending beyond each side of opening.
- D. Where required, all openings shall be protected by a rated protection system listed for the specific application for the type of material penetrating the fire barrier and the type of construction of barrier penetrated. Sealants used in floor penetrations shall be waterproof.
- E. Where piping or other items, that are provided for under this contract, penetrate fire rated walls or floors, the Contractor shall seal around the item to maintain the integrity of the rated system. All openings shall be protected by a rated protection system listed for the type of material penetrating the fire barrier and the type of construction of barrier penetrated. Sealants used for floor penetrations shall be waterproof. Systems shall be UL rated for two hours minimum. Submit system proposed for review. Provide documentation to the General Contractor and Architect for each type fire protection sealing system utilized in this project. The Fire Marshal Inspector may perform random destructive sampling of the sealant system installation; Contractor shall repair seal at sampling locations.
- F. For openings containing non-metallic material, piping, conduit or wiring, and penetrating a floor-ceiling assembly, the system shall include intumescent material and shall be a listed "through penetration" assembly tested in accordance with ASTM E-814.
- G. For precast concrete floor and wall systems, openings 8 inches round or 8 inches square and larger shall be by the precast concrete supplier. Openings smaller than 8 inches round or 8 inches square shall be by the Contractor and shall be core drilled or saw cut in the field.

3.03 ACCESS PANELS

- A. Access panels in ceilings and walls shall be steel doors with heavy duty concealed hinges of the pinless type and screw driver locks. Doors shall be prime coat finished.
- B. Provide access panels in the ceilings and walls for switches, valves, etc. These access panels are for installation by others, but the Contractor is responsible for their proper location. Contractor shall coordinate with other trades to minimize the number of access panels required. Locate items requiring access in close proximity to other trades items requiring access where feasible.
- C. Access panels in fire rated ceiling/walls shall be UL labeled to meet the requirements of the rated assembly and shall have a closer device to automatically close and latch the door upon

release from any open position. Fire rated access panels shall have key operated locks with spare set of keys (turn over to Owner).

- D. Where lay-in or other easily removable ceilings exist, no access panels are required.

3.04 EXCAVATING, TRENCHING AND BACKFILLING

- A. Protect trench and handle materials in accordance with good safety practice. All pipes shall be installed with minimum 24 inch cover wherever possible and in no case less than 12 inch cover.
- B. The bottom of the trenches shall be accurately graded. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Wherever unstable soil is encountered, such soil shall be removed and the trench backfilled to proper grade with coarse sand or fine gravel.
- C. After all required tests and inspections have been performed, the trenches shall be carefully backfilled with materials approved for backfilling, deposited in 9 inch layers and thoroughly and carefully tamped. Repeat backfill as required after any subsequent settlement.
- D. Refer to other sections of this Specification for additional requirements for trenching, backfill, bedding, compaction, etc.

3.05 CLEANING AND STERILIZATION

- A. When all work has been finally tested, clean all fixtures, pipes and exposed work. All pipes shall be free of all obstructions. Thoroughly clean and polish all plated and other finished products.

END OF SECTION

SECTION 210020 - FIRE SUPPRESSION PIPING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install in a neat, workmanlike manner all piping shown on Drawings or that is specified or required to provide a complete, properly operating installation.
- B. The Contractor shall provide a small ready fire extinguisher at all welding and cutting operations indoors.

1.02 SERVICE CONNECTIONS

- A. All connections to services shall be verified by the Contractor. Where costs for service connections are incurred, the Contractor shall include these costs in his bid.

1.03 TESTING

- A. Test all piping and prove tight to the satisfaction of the Architect before covering is applied, trenches backfilled or fixtures connected.
- B. Notice shall be given to the Architect and to the Fire Marshal a minimum of 72 hours prior to the tests are made. The test shall not be drawn off the pipes and pipes shall not be covered until the filled pipes have been examined and the testing approved by the Architect and Fire Marshal.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide materials necessary to accomplish the installation of the piping systems.

PART 3 - EXECUTION

3.01 PIPE JOINTS

- A. Threaded joints shall be American Standard taper pipe threads made up metal-to-metal with a thread lubricant. No hard setting pipe thread cement or caulking will be allowed. Cut threads so that a maximum of three threads remain exposed after the fitting is made up. Ream all pipe ends after cutting and clean before erection.
- B. Welded Joints/Procedures:
 - 1. Make welded joints by the metallic arc or gas welding process in accordance with current version of American Welding Society (AWS) D10.12M/D10.12. Welding electrodes shall have coating and diameter as required by the manufacturer for the type and thickness of work being done.
 - 2. The preferred method of field cutting piping shall be with a band saw or abrasive wheel with the cut edge perpendicular to the length of the pipe. Pipe cuts using hand torch methods may be utilized provided the torch cutting process occurs at a location exterior of the finished building, the rough edges of the torch cut pipe is prepared

for welding by field grinding and the root opening tolerances of the weld joint is maintained.

3. All pipe ends for welding shall be beveled. Machine beveling in shop is preferred. Field beveling may be done by flame cutting or grinding to recognized standards; however flame cutting shall occur at the exterior of the finished building. The bevel angle shall be uniform and shall be approximately 37° leaving a 1/8" high face at the inside edge of the pipe.
4. Pipe sections to be welded shall be aligned such that the surfaces to be joined are parallel to each other, and the groove to be welded is uniform and approximately 75° wide. The root of the pipe shall be separated by no more than 1/8".
5. The root shall be welded in a single pass with the rod perpendicular to the center line of the pipe.
6. The groove remainder shall have a series of fill welds to cover the height of the groove. Each fill weld shall be a single pass and shall be repeated until the groove is filled.
7. The final weld shall be a corner weld, single pass covering the full width of the welded joint.
8. All welds shall be uniform in width and depth and free of cracks, holes, sputter points, cold laps and points and gouges in the pipe wall.
9. All fittings in welded piping shall be factory-fabricated seamless welding fittings conforming to ANSI B16.9 and constructed of the same material and weight (or schedule) as the piping attached. Where the size of a branch take-off does not exceed 2/3 of the diameter of the main to which connected and the main is 2-1/2" diameter or larger, branch take-offs may be made with factory fabricated "O-LET" fittings, to match the class of fabrication.
10. Welds found not complying with the above methods or otherwise appear to employ poor workmanship shall be selected by the Architect for X-ray analysis with the cost borne by the Contractor. Unsuitable welds shall be removed and, using new pipe, remade.
11. Prior to bid, Contractor shall verify with Architect and Owner if welding operations will be restricted or not allowed within the building. Where not allowed, Contractor shall provide an alternative joining method, such as grooved or flanged fittings, and allow for this in his bid. All alternate joining methods shall be approved by the Architect before proceeding. Contractor shall submit for prior approval before bid. Failure to coordinate, and the associated cost implications, shall be the Contractor's responsibility.

3.02 SLEEVES AND PLATES

- A. Wherever pipes pass through concrete or masonry walls or structural slabs, furnish and install sleeves, properly located for the work. Where pipes pass through monolithic concrete floors, omit sleeves and use double wrap of 15 pound tarred felt.
- B. Sleeves shall be of sufficient size to allow the specified pipe covering to pass through the sleeves. Finish flush with floors where exposed to view in finished areas of the building, 2 inches above floors where in equipment rooms and furred spaces and 6 inches above roofs. Seal all spaces between sleeves and pipes or pipe coverings. Use method as described under 210010 - OPENINGS, CUTTING AND PATCHING or ceramic fiber packing or a mechanical device for fire rating to match wall or floor.

3.03 ESCUTCHEONS

- A. Where pipes, passing through walls, floors and ceilings, are exposed to view in finished areas of the building, provide nickel plated pressed steel split floor and ceiling plates which shall cover the opening and fit snugly to the pipe or covering.

3.04 ACCESS DOORS

- A. Provide access doors in ceilings and walls where required for access to valves and other devices. Doors shall be as specified under 210010 – FIRE SUPPRESSION BASIC MATERIALS AND METHODS. Where lay-in or other easily removable ceilings exist, no access doors are required.

3.05 PIPE SUPPORTS

- A. In general, suspend horizontal runs of pipe from the overhead construction using steel clevis type, band type or split ring malleable iron hangers, suitable for the pipe size and weight. Anchor hanger rods to building construction using beam clamps, inserts, weld clips, drilled bolts and nuts, etc. Any straight up nails, wood bolts or concrete expansion shields will not be allowed. Verify final exact hanging arrangement with the Architect. See Drawings for additional support information. Size rods as follows:

<u>Pipe Size, Inches</u>	<u>Rod Diameter, Inches</u>
2 and Smaller	3/8
2-1/2 and 3	1/2
4	5/8
6 - 8	3/4
10 - 12	7/8
14 - 18	1

- B. Where two or more pipes run parallel and at the same location, they may be supported on channel or angle iron trapeze hangers, suspended from the overhead construction by rods same as specified for single hung pipe, except that the hanger rods shall be increased in size to support the additional weight. Thread lower ends of hanger rods 2 inches for adjustment and provide with nuts at top and bottom of channels. Upon completion of work, cut the rods off to present a neat appearance. Provide dielectric material between pipe and support where made of different materials.
- C. Unless otherwise specified herein or on Drawings, space hangers for steel pipe at not more than 5 feet for pipe 1 inch and smaller and at not more than 10 feet for pipe 1-1/4 inches and larger.
- D. Provide supports and anchors for all pipe in horizontal or vertical position as required for installation satisfactory to Architect.

3.06 PIPE FLASHINGS

- A. Where pipes extend through roof or outside walls, use flashings as required for weatherproofing. Roof flashings shall be lead with minimum 10 inch turnout and rolled into top of pipe. Wall flashings may consist of suitable caulking.
- B. For metal panel roofing systems, flashings shall be T.W. Buildex Dek Tite, The Pate Co. Pipe Flashing Device, or equal, conical shaped, long life E.P.D.M. rubber stepped boot assembly

with flexible aluminum base ring. For conforming to contour of metal roofing panel, provide required sealant caulking, self-sealing fasteners and accessories necessary for installation in accordance with manufacturer's requirements to insure a weather-tight/rain-tight installation.

3.07 PIPING INSTALLATION

- A. Run piping parallel with lines of the building, unless specified or noted otherwise. All pipe shall have minimum one-half inch clearance from other work, including coverings.
- B. Install piping so as to eliminate air pockets and permit complete drainage, providing air vents at all high points and drains at all low points. Install piping so that it can expand or contract freely.

3.08 UNDERGROUND PIPING WARNING TAPE

- A. For underground fire water piping, provide warning tape installed directly above underground piping (beyond building slab). Tape shall be placed at 12 to 18 inches below finished grade. Warning tape shall be metallic detectable type consisting of 0.35 mils thick solid foil core encased in a protective plastic jacket that is resistant to alkalis, acids and other destructive elements found in the soil. The lamination bond shall be strong enough that the layers cannot be separated by hand. Total composite thickness to be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. Warning tape for metallic piping may be 0.4 mils polyethylene film without metallic laminate.
- B. A continuous warning message repeated every 16 to 36 inches shall be imprinted on the tape surface. The tape shall contain an opaque color concentrate designating the color code appropriate to the line being buried. Tape shall be minimum of 3 inches wide.

END OF SECTION

SECTION 210030 - FIRE SUPPRESSION PIPING MATERIALS

PART 1 - GENERAL

1.01 SCOPE

- A. Piping within air ducts, plenums or other similar compartments used as part of an air distribution system shall be non-combustible or have a flame spread of not over 25, and shall have a smoke developed rating no higher than 50; no plastic piping is allowed in such spaces unless specifically rated for such service.
- B. All steel pipe shall be in accordance with the "American Standards for Wrought Steel Pipe." Piping materials shall be in accordance with the following.

PART 2 - PRODUCTS

2.01 FIRE LINE PIPING

- A. Where indicated on Drawings, furnish and install exterior fire line piping as specified in Section 210040.

2.02 FITTINGS

- A. Screwed fittings shall be fine grain full weight malleable cast iron as specified, with smooth cut tapered threads. Welding fittings shall be seamless steel full standard weight. Mitered ells or notched tees will not be allowed. Where pipe 2 inches and smaller tees into pipe 2-1/2 inches and larger, threaded or welded saddle fittings may be used for tees where the branch size is not more than one-half the main size.
- B. Companion Flanges 2-1/2 inches and larger shall be 150 pound forged steel slip-on or welding neck type with raised face. Companion flanges 2 inches and smaller shall be standard 125 pound cast iron, screwed pattern. Flange bolts and nuts shall conform with ASTM A307, Grade B. Gaskets shall be suitable for the service intended.
- C. Gasket/mechanical joint fittings shall be cast or ductile iron Class 250 (minimum) produced in accordance with AWWA C-111.

2.03 BACKFLOW PREVENTERS

- A. Refer to Drawing Sheet F0.0, Detail 7 for backflow preventer specification.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install all equipment, piping and accessories as per manufacturer's requirements.
- B. Fire line piping shall be installed in accordance with requirements of National Fire Protection Association (NFPA) 24, Private Fire Service Mains And Their Appurtenances.
- C. Where allowed by the preceding Specifications, plastic piping below slabs, drives or other paved surfaces must be installed at minimum depth of 3'-0 inches below finished pavement.

END OF SECTION

SECTION 210040 - FIRE SUPPRESSION SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. The General Requirements of the Contract and Supplementary Conditions of the Contract shall govern the work under this section of the Specifications. The Contractor is specifically directed to refer to said Conditions.
- B. It is understood that these Specifications, and the accompanying Drawings, contemplate complete apparatus, fully erected and in successful operating condition. All work shall be performed in the best and most substantial manner. All materials, piping, fittings, heads and accessories shall be new.
- C. These Specifications are intended to provide complete, and in proper operation, all sprinkler system piping, equipment, heads, valves, drain piping, controls and accessories, all as specified herein or shown on the accompanying Drawings, or reasonably implied in either. The building shall be provided with complete coverage sprinkler system, classification as required. Include a separate valved zone branch serving any elevator shaft and equipment areas. System shall consist of a calculated wet system unless indicated otherwise. Verify all pertinent criteria. The systems shall conform to layout shown and meet all requirements of agencies listed under "REGULATIONS AND STANDARDS" below. Refer to Drawings for additional information.
- D. Sprinkler piping system shall be installed so as not to obstruct service access to mechanical and electrical equipment, such as but not limited to fans and electrical panels; install/offset piping as necessary to maintain required service access. **SPRINKLER SYSTEM CONTRACTOR SHALL COORDINATE WITH THE MECHANICAL CONTRACTOR AND ELECTRICAL CONTRACTOR AND ROUTE PIPING AROUND THEIR WORK. THE WORK OF THE SHEET METAL AND LIGHTING FIXTURES SHALL TAKE PRECEDENCE FOR THE POSITION OF THE DEVICES IN THE AVAILABLE CEILING SPACE. ANY CONFLICT WITH ANY SYSTEM, THE SPRINKLER PIPING SHALL MOVE. EXCEPT WHERE NOTED OTHERWISE ON DRAWINGS, ALL PIPING SHALL BE CONCEALED.**
- E. Hydraulic calculations shall include an allowance for hose(s). Water velocity in sprinkler piping shall not exceed 20 feet per second at design water flow rate, and friction loss shall not exceed 0.35 psi per linear foot of piping.
- F. All spaces of the building shall be completely protected by automatic wet-pipe sprinkler system for the occupancy hazard intended for the individual spaces. Wet-pipe systems must be hydraulically calculated for a minimum of 0.1 GPM per sq. ft. for the most remote 1,500 sq. ft.
- G. In elevator machine rooms, electrical switchgear rooms, transformer areas, electrical closets and elevator shafts, sprinkler protection shall be designed for 0.15 GPM per sq. ft. over the most remote 3,000 sq. ft. Provide wire guards over sprinklers within these spaces and in mechanical rooms.
- H. All costs for sprinkler service, piping mains and utility company charges, shall be included in this work.

- I. **THE CONTRACTOR SHALL COORDINATE WITH THE SHEET METAL CONTRACTOR AND ELECTRICAL CONTRACTOR AND ROUTE PIPING AROUND THEIR WORK. THE WORK OF THE SHEET METAL AND LIGHTING FIXTURES SHALL TAKE PRECEDENCE FOR THE POSITION OF THE DEVICES IN THE AVAILABLE CEILING SPACE. ANY CONFLICTS WITH ANY SYSTEM, THE SPRINKLER PIPING SHALL MOVE. ALL PIPING SHALL BE CONCEALED.**

1.02 SYSTEM LAYOUT

- A. Where Drawings indicate layout of system components, the layout shall be verified to comply with "REGULATIONS AND STANDARDS" and shall be revised if required to comply. Revision shall be at Contractor's expense. Any such revisions shall be verified with the Architect.
- B. Sprinklers shall be placed at center points of 2'-0" x 2'-0" lay-in ceiling tiles and symmetrically in other ceiling types. Prior to shop drawings submittal, Contractor shall meet with Architect to verify desired layout and finish of sprinkler system. . Coordinate sprinkler layout with light fixtures, speakers, HVAC grilles/diffusers, etc., and resolve any conflicts/discrepancies with project's Field Architect. Refer to architectural reflected ceiling plans for ceiling appurtenances.
- C. Sprinkler layouts shown these Drawings are to establish desired arrangement and areas to be sprinkled. Contractor shall provide additional sprinklers or adjust sprinkler location and/or type where required to satisfy Code Regulations, Contract Documents and Code Authorities. System required is not necessarily limited to the number of heads and locations shown.
- D. Sprinkler piping shall be routed free and clear of structural elements, ductwork, conduit and piping. Coordinate with the other trades and arrange sprinkler piping around others. Where sprinkler piping is in conflict with ductwork or structural elements, reroute sprinkler piping without cost to the Owner.

1.03 ELECTRICAL WORK

- A. See "COORDINATION."

1.04 SPRINKLER SYSTEM CONTRACTOR

- A. It is intended that the work under this section of the Specifications shall be performed by a qualified Fire Protection Piping System Contractor regularly engaged in this type of work. This Contractor shall hold a current license to perform this work and be certified by the State Fire Marshal. All documents shall bear this certification.

1.05 REGULATIONS AND STANDARDS

- A. It is the intention of these Specifications and the accompanying Drawings, that all elements and features of the fire protection system shall be in accordance with the standards of the National Fire Protection Association (NFPA), the State Fire Marshal, the applicable building Codes and Property Ins. Association of Louisiana whether so indicated or not. NFPA standards are on file in office of Architect and may be examined at the Contractor's request. Standards and Codes applicable, but not limited to, shall be the latest editions adopted by the authorities having jurisdiction for the following:
1. NFPA 13: Installation of Sprinkler Systems
 2. NFPA 14: Installation of Standpipe and Hose Systems
 3. NFPA 20: Installation of Centrifugal Fire Pumps

4. NFPA 24: Private Fire Service Mains and Their Appurtenances
5. NFPA 101: Life Safety Code
6. IBC: International Building Code
7. IFC: International Fire Code
8. ASME A17.1: Safety Code for Elevators and Escalators

1.06 AREAS SUBJECT TO FREEZING

- A. For areas requiring protection and not receiving direct heating during times of potential freezing, such as building overhangs, porches, equipment rooms, canopies, attics, etc., provide a dry pipe system or anti-freeze loop system for these areas only.

1.07 SHOP DRAWINGS AND SUBMITTAL DATA

- A. Within thirty (30) days of award of the Contract, the Contractor shall submit **digital data files** of fire protection system piping drawings and manufacturer's data and descriptive literature for all equipment and materials for the purposes of coordination with other building systems. Digital data files shall be DWG format, AutoCAD Version 2015 and PDF or later, in Microsoft Windows operating system. Provide individual DWG files for each drawing sheet. Drawings shall locate sprinkler mains, branch lines, sprinkler heads and piping hangers, utilizing architectural floor plan background drawings.
- B. Drawings, literature and data on all fire protection system equipment shall be submitted at the same time; this material shall contain complete layout, capacity data, dimensions and all other pertinent information necessary for the Architect to properly review and evaluate the components and that necessary to meet the requirements for submittal to the State Fire Marshal.
- C. The Contractor shall obtain approval of agencies listed under "REGULATIONS AND STANDARDS" before submitting to the Architect, except that data for State Fire Marshal's review shall be submitted to the Architect prior to submitting to the Fire Marshal. All required review fees and application requirements shall be by the Contractor. No item of equipment or material shall be placed on order until Final Review comments have been received from the Architect. See "DRAWINGS" below.

1.08 ORDINANCES, RULES AND REGULATIONS

- A. All material and construction shall conform to the requirements of all building sanitary codes and laws currently enforced in the locality in which the work shall be done. All materials and construction shall also conform to the rules and regulations listed above under "REGULATIONS AND STANDARDS."

1.09 DRAWINGS

- A. The Contractor shall submit detailed drawings for all sprinkler systems showing exact locations and sizes of all elements in the systems before fabrication is begun. Architect shall have the prerogative of changing the position or configuration of these systems without changing the total scope of work involved to comply with "REGULATIONS AND STANDARDS" and to comply with structural requirements for piping hanger attachment to the building framing/trusses.
- B. Drawings shall include connection to water source with all pertinent and current water source data.

1.10 GUARANTEE

- A. The Contractor shall guarantee all materials and workmanship under this Contract for a period of one year from date of final acceptance of his work and shall repair or replace any such defective materials and workmanship without cost to the Owner.
- B. The guarantee shall include complete service, including adjustment service and inspection, during the guarantee period as required by agencies listed under "REGULATIONS AND STANDARDS."

PART 2 - PRODUCTS

2.01 PIPING

- A. General: Furnish and install in a neat workmanlike manner, all piping shown on Drawings or that is specified or required to provide a complete, properly operating installation. This includes fire lines, sprinkler supply piping, drain piping, etc. All piping and accessories shall conform to standards as applicable.
- B. Run piping parallel with the lines of the building, unless specifically shown or noted otherwise. All pipe, fittings, valves, etc., shall have sufficient clearance from other work to finish at least 2 inches from other work or finished covering of other piping.
- C. Provide all necessary hangers, anchors, thrust blocks, etc., to properly support and protect piping system, as required by agencies listed under "REGULATIONS AND STANDARDS."
- D. Under no circumstances shall the Contractor attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems are to be approved by the Architect. All supplemental angle or channel iron required to support equipment of this Specification shall be furnished by the Contractor and shall be independent of any other supports.

2.02 SLEEVES AND PLATES

- A. Wherever pipes pass through concrete slabs, furnish and install sleeves, properly located for the work.
- B. Use sleeves of sufficient size to allow the specified pipe covering to pass through the sleeves and finish sleeves flush with walls and ceiling.
- C. Sleeves shall be galvanized steel not lighter than 24 gauge.
- D. Seal spaces between sleeve and pipe. Use packing device or material for UL rating to match rating of wall or floor/ceiling as rated under UL File R9658.

2.03 ESCUTCHEONS

- A. Where pipes passing through floors, walls or ceiling exposed to view in finished areas, provide pressed steel split plates which cover the opening and fit snugly to pipe.

2.04 PIPING MATERIALS

- A. All piping shall be in accordance with the NFPA 13 and applicable sections of NFPA 24. Piping materials shall be in accordance with the following:

1. Interior Sprinkler Piping: (Including Standpipes and Risers) Schedule 40 steel pipe with approved cast iron or malleable iron threaded or grooved end fittings. Piping may be joined by approved welding methods with listed fittings. Piping 5 inches in diameter and larger joined by approved welding or roll grooved methods may be Schedule 10, in accordance with NFPA 13:6.3.2.
2. Drain Piping: All piping subject to alternatively wetting and drying cycles such as test and drain piping shall be Schedule 40 galvanized steel with screwed galvanized malleable iron fittings.
3. Piping for Dry Pipe and Pre-Action Sprinkler Systems: Pipe and fittings shall be same as specified for drain piping.
4. Exterior Fire Piping: Approved cast iron or ductile iron water pipe with mechanical joints, 250 lb. pressure class. Piping beyond five feet outside the building walls may be AWWA Standard C-900 PVC pressure pipe Class 150. The pipe shall have an integral bell end with a pressure pipe elastomeric ring type seal. The pipe shall be manufactured to cast or ductile iron size outside dimensions. Fittings shall be gasket/mechanical joint cast or ductile iron, Class 250 (minimum) produced in accordance with AWWA C-111.

2.05 VALVES

- A. Furnish and install all valves as indicated or as required by agencies listed under "REGULATIONS AND STANDARDS." See also "MONITORING DEVICES."

2.06 SPRINKLER HEADS

- A. Provide heads, type and location as required for the classification determined. Except where indicated otherwise on Drawings, heads in areas with finished ceilings shall be pendent mounted, concealed type, color of cap to match color of ceiling. All sprinkler heads shall be new. All heads shown to be relocated shall have the existing head removed, piping adjusted to the new position and a new head used in the new position.
- B. Except where required otherwise, sprinklers in light hazard occupancies shall be quick-response type.
- C. For sprinklers installed in areas exposed to outdoor environments (such as exterior canopies, walkways), heads shall have corrosion resistant coating.

2.07 FLOW SWITCHES

- A. Provide flow switches at main entrances and zones as required. Flow switches shall be either paddle type or pressure actuated type, and UL listed as compatible with the service. If flow paddle type switches are used, include a 3 psig pressure drop allowance or provide manufacturer's documentation otherwise.

2.08 MONITORING DEVICES - REQUIRED SYSTEMS

- A. Where the sprinkler system is installed to comply with a Code requirement, the sprinkler system must be designed with Factory Mutual approved water flow alarm switch(es) designed for connection by others. Monitoring switches shall be Factory Mutual approved gate valve switches for supervision of each O. S. & Y. valve. This monitor switch will require the plunger operator to "ride" along the tangent of the valve stem. Monitor switches employing the center-line type action of the plunger to the stem are not acceptable.

- B. Monitored zone valves 1 inch to 2-1/2 inches in size may be Factory Mutual approved supervised slow close indicating type butterfly valves. Flow switches, monitor switches and monitored zone valves shall be submitted for approval. Coordinate with the Fire Detection System Equipment Supplier. Refer to Drawings.

2.09 AIR COMPRESSORS

- A. Air compressors for dry pipe and/or pre-action sprinkler systems shall be a packaged assembly, listed for the application. The air compressor assembly shall be style with compressor and motor mounted to the receiver tank. Include air pressure maintenance device, pressure switch and all required accessories.

2.10 FIRE PUMP SYSTEM

A. General:

- 1. Furnish and install where shown on Drawings a complete fire pump system with fire pump, driver, jockey pump, automatic transfer switch, controllers and accessories. The pumping unit shall be listed by UL. The pumping unit shall meet all requirement of the National Fire Protection Association Pamphlet No. 20.

B. Fire Pump:

- 1. The fire pump shall be designed to deliver specified GPM at operating pressure as stated on Drawings. The pump shall also deliver not less than 150% of rated capacity at a pressure not less than 65% of rated pressure. The shut off pressure shall not exceed 120% of rated pressure. The fire pump shall operate at a maximum synchronous speed of 1150, 1770 or 3500 rpm. The fire pump shall be by Aurora or equal as listed by addendum, vertical, inline type, bronze fitted, single stage, centrifugal pump.
- 2. The driver shall be a horizontal, open drip-proof, ball bearing type, AC, induction, squirrel cage "P" face motor; refer to Drawings for voltage and phase. The motor shall be of such capacity that 115% of the full load ampere rating shall not be exceeded at any condition of pump load for UL Listed Fire Pump Systems. Locked rotor current shall not exceed the values specified in NFPA Pamphlet No. 20. Motor shall be UL listed for the fire pump service.
- 3. The fire pump unit shall include (but not be limited to) the following accessories, as required by NFPA Standards:
 - a. Pressure Gauges
 - b. Circulation Relief Valve
 - c. Automatic Air Release Valve
 - d. Coupling Guard
 - e. Flow Metering Device
 - f. Hose Valve Test Header with Caps and Chains

C. Fire Pump Controller:

- 1. The fire pump controller shall be listed by UL and approved by Factory Mutual Research for fire pump service. The controller shall meet the requirements of NFPA 20. The controller shall be suitable for use on a circuit capable of delivering 100,000 amps symmetrical short circuit current. It shall be completely factory wired, assembled and tested prior to shipment.

2. The controller shall be of the combined manual automatic type sized to match the pump motor specified hereinbefore and designed for across-the-line starting. The controller shall be housed in a NEMA 2 drip-proof indoor enclosure, fabricated from heavy gauge cold rolled steel per the requirements of UL 508.
3. All controller components shall be UL listed or UL recognized, shall be front mounted and wired, allowing the controller to mount flush against a wall.
4. The controller shall include an isolating switch and circuit breaker rated at least 115% of the motor full load current. The isolating switch and circuit breaker shall be externally operable via a single operating handle. When moving the handle from the OFF to ON position, the handle shall sequence the isolating switch on first and then the circuit breaker. When the handle is moved from the ON to the OFF position, the handle shall sequence the circuit breaker off first and then the isolating switch. This sequencing operation shall prevent the isolating switch from interrupting motor current. The operating handle shall be capable of being padlocked in either the ON or OFF position. The operating handle shall permit normal tripping operation of the circuit breaker.
5. The circuit breaker overcurrent sensor shall be of the solid state microprocessor type and shall be internal to the circuit breaker. The circuit breaker shall be calibrated up to and set at 300% of motor full load current and shall have a trip time of between 8 and 20 seconds at 600% of motor full load current.
6. Provisions shall be made between the circuit breaker and the isolating switch for using a clamp-on type ammeter to measure motor current draw.
7. The controller shall include a NEMA rated contactor capable of being operated by an external emergency operating handle.
8. A pressure switch shall also be furnished which is of the bourdon tube type with adjustable independent high and low setpoints, and a range of 10 to 300 psi. The pressure switch shall be capable of being sealed to prevent unauthorized adjustment. The pressure switch shall be mounted inside the controller cabinet and piped to an external coupling for field connection.
9. Externally mounted pilot lights shall be furnished to indicate controller primary power is available and phase reversal of primary power.
10. A running period timer shall be provided to keep the motor running when started automatically. The timer shall have a pilot to indicate when the timer is operating. This timer shall be set a ten minutes minimum. The controller shall be factory set for manual stop with terminals provided to allow field conversion to automatic stop.
11. The control circuit transformer shall be of the heavy duty type with a minimum rating of 150 VA without integral overcurrent protection per the requirements of NFPA 20.
12. Dry alarm contacts for remote alarm of "Pump Running", "Controller Power Available" and "Phase Reversal" shall be supplied. One normally open and one normally closed contact for each alarm shall be supplied. Controller power shall be monitored by a three phase power monitor. The monitor shall trip on either of loss of control voltage, single phase, loss of power and phase reversal.
13. A circuit for manual remote starting of the controller shall be supplied requiring only a contact closure to initiate. This circuit shall not be capable of stopping the controller remotely per the requirements of NFPA 20.
14. The controller shall be completely tested at the factory prior to shipment. This test shall verify proper operation of all normal automatic and manual functions along with the continuity of all dry contacts for remote alarms. The test shall also include a high potential voltage test of all primary power circuits equal to twice the rated voltage plus 1000 volts for one minute.
15. The controller shall be as manufactured by Metron Inc., Firetrol, or equal as listed by addendum.
16. Provide, as an integral part of the fire pump controller, an automatic transfer switch. The automatic transfer switch shall be a 3 pole double throw mechanism that is

electrically operated and mechanically held. The transfer switch shall be configured for normal utility power to emergency generator power transfer operation. The transfer switch shall have normally open and closed auxiliary contacts for each input. Unit to be Firetrol FTA Series, Metron MTS Series, or equal as listed by addendum.

D. Jockey Pump and Controller:

1. Furnish and install, as shown on the Drawings, approved jockey pump for maintaining full pressure of the fire protection system. Pump shall be turbine type, single-stage, bronze-fitted pump, with renewable bronze liners and impellers, furnished with stainless steel shaft.
2. Jockey pump shall be furnished with 3/4 inch circulating relief valve.
3. Jockey pump shall be furnished with combination magnetic across-the-line starter with fusible disconnect switch, hand-off-automatic selector switch with three-leg protection and including pressure switch. All to be mounted in a NEMA 3R enclosure for electrical service as indicated on Drawings.

E. Remote Alarm Panel:

1. Provide a UL listed alarm panel designed to meet the requirements of NFPA 20. Panel shall be in a NEMA Type 2 drip-proof enclosure. Alarm signals shall include "Motor Running", "Loss of Power" and "Phase Reversal" as a minimum. Remotely locate this panel in the central control room, or as noted on the Drawings.

2.11 ACCESS DOORS

- A. Provide access doors in ceilings and walls where required for access to valves and other devices. Doors shall be as specified under "BASIC MATERIALS AND METHODS." Where lay-in or other easily removable ceilings exist, no access doors are required.

PART 3 - EXECUTION

3.01 OPENINGS, CUTTING AND PATCHING

- A. All cutting and patching is covered generally under another section of these Specifications. This Contractor shall coordinate with the General Contractor and do any cutting or patching not otherwise covered for this work.

3.02 STARTING, TESTING AND INSTRUCTION

- A. The Contractor shall perform such cleaning, testing and Owner Maintenance Instruction as required by agencies listed under "REGULATIONS AND STANDARDS."
- B. Provide inspector's test and drain at hydraulically most remote area(s). Provide required signs identifying each control valve, alarm valve and drain valve, as applicable.

3.03 COORDINATION

- A. A smoke detector (by Fire Alarm System Contractor) is to be installed in the elevator machine room. Activation is to recall elevator to the designated floor.
- B. Heat detectors and smoke detectors (by Fire Alarm System Contractor) are to be installed within 2'-0" of each sprinkler within elevator machine rooms and shafts. Coordinate with Electrical Work.

- C. Sprinklers shall be provided within elevator machine rooms and both top and bottom of elevator shafts. Sprinklers within these spaces shall be rated for 200°F to 225°F (12°F minimum above heat detectors) and shall have wire guard protection devices.
- D. Sprinkler systems in elevator machine rooms and shafts shall conform with ASME A17.1.
- E. Coordinate all sprinkler alarm/supervisory tie-in connections with Fire Alarm System Contractor. Any fire protection system control valve(s) not shown in these Drawings, but required either by local Code Authorities or Contractor's discretion, shall be supervised via the building fire alarm system, and costs for such installation shall be included in the sprinkler contract; coordinate with Electrical Contractor.
- F. This Contractor shall provide for all the switches and interlocking devices on all valves as required.
- G. All sprinkler piping shall be coordinated with building systems, structural elements, ductwork, conduit, HVAC equipment, ceilings, furrings and light fixtures and other ceiling mounted equipment. Routing of HVAC ductwork shall have precedence over sprinkler piping: Where piping is in conflict with ductwork, the piping shall be moved. Where piping and head placement conflicts with ceiling diffusers or wall grilles, or lighting fixtures, the piping and/or heads shall be moved.

3.04 UNDERGROUND PIPING

- A. Underground fire protection system piping shall be installed in accordance with the requirements of NFPA-24, *Private Fire Service Mains and Their Appurtenances*. Provide concrete thrust blocking at each change in direction of the piping and at all tees, plugs and caps in accordance with NFPA-24. Where thrust blocking is impractical, fittings with a mechanical joint retainer gland, approved for the piping material utilized, may be used in lieu of thrust blocking.

END OF SECTION

SECTION 220000 - PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

- A. These Specifications are intended to provide complete and in proper operation all plumbing systems, all as specified herein or shown on the accompanying Drawings, or reasonably implied in either, and including roughing-in services and connections for equipment furnished under other contracts or by the Owner, unless shown otherwise. The term "the Contractor" as used in this section of these Specifications shall denote the Plumbing Sub-Contractor.
- B. All electrical work, associated with the plumbing system, shall be done under the Electrical Section of these Specifications, except where indicated. See DIVISION 26 - ELECTRICAL for coordination. Furnish wiring diagrams and any other information required for all wiring in connection with Plumbing Equipment and Controls.
- C. Painting, except for special coats as herein specified, is included in other sections of the Specifications, see DIVISION 09 - FINISHES. The Contractor shall coordinate and inform DIVISION 09 Tradesman for the painting of all non-insulated or coated piping, support steel and fittings including valves. This piping shall include steel piping, supports, valves, flanges and hangers. It does not include cast iron or plastic or copper piping. It shall include touch up on welding for equipment having factory finishes. It is intended that all piping not insulated or manufacturer pre-coated (as for example, galvanized) and all other metals furnished and installed under this subcontract that are subject to rusting or discoloration be painted. Before finished coat of painting is applied, items outdoors and indoors shall have a base coat of cold galvanizing compound or industrial grade rust inhibiting primer (compatible with final coating).
- D. The Contractor shall verify all utility tie-in points for exact location, elevation and size and shall verify all routings and determine any interference with existing obstructions or obstructions that might result from other work in this project.
- E. The Plumbing Contractor shall be responsible for reviewing the Specifications and Drawings provided by the Medical Equipment Consultant. Plumbing Contractor shall provide all necessary piping, fittings, and accessories as required to complete a fully functioning plumbing system in accordance with Medical Equipment Consultant requirements and these Specifications.
- F. All plumbing work shall be coordinated with all other trades prior to installation to avoid conflicts. Work installed without being coordinated shall be susceptible to removal and reinstallation at no cost to the Owner. In general, pressure piping shall be routed around ductwork, lights, structure, etc. Gravity drainage piping shall take precedent to maintain Code required slopes but must be closely coordinated with other trades to maximize ceiling space utilization.

1.02 GENERAL CONDITIONS

- A. The Instructions to Bidders, General Conditions and Special and Supplementary Conditions, all contained in DIVISION 01 - GENERAL REQUIREMENTS, shall be part of this section of the Specifications the same as if attached hereto. The Plumbing Contractor shall read and be thoroughly familiar with all provisions of DIVISION 01.
- B. It is understood that these Specifications and the accompanying Drawings, contemplate complete apparatus, fully erected and in successful operating condition. All work shall be performed in the best and most substantial manner.

1.03 MANUFACTURERS OR TRADE NAMES

- A. Where the Drawings and Specifications mention the products of specific manufacturers, it is intended that the Contractor shall furnish the items as specified, or a substitute listed by addendum to the Specifications. Request for substitution shall be made in writing at least seven working days before bids are taken unless required otherwise in the Architectural Specifications. Requests shall include all materials necessary and exact model numbers proposed to fully evaluate the substitution or they will not be considered for review. Request shall also show where the substitution is compliant with the Specifications and any deviations from the Specifications or they will be rejected. The burden of equivalency shall be on the Contractor.
- B. The Contractor shall bid all materials as specified in these Specifications, Drawings, and Addenda. Should the Contractor submit a bid that is not inclusive of all project document requirements, the Contractor shall be responsible for all cost associated to align his materials to comply with project documents.

1.04 ORDINANCES, RULES AND REGULATIONS

- A. All material and construction shall conform to the requirements of all building codes, sanitary codes and laws and ordinances currently enforced in the locality in which the work shall be done. All materials and construction shall also conform to the rules and regulations of the National Fire Protection Association, Underwriter's Laboratories and National Electrical Manufacturers' Association.
- B. Plumbing systems shall be in accordance with the 2021 Edition of the International Plumbing Code (IPC), as adopted and amended by the State of Louisiana, hereafter identified as the "Plumbing Code".

1.05 PERMITS, FEES AND INSPECTIONS

- A. Contractor shall obtain all permits and inspections required in connection with this work and shall pay any fees or other costs involved. Inspections shall include (but not be limited to) boilers, water heaters, etc., as required by State and/or Local Regulating Authorities for the system(s) to be installed. Unless indicated otherwise, Contractor shall coordinate with the various companies and pay fees required for utility service connections and meters, including gas, sewer, storm drain, sewerage impact fees and domestic water systems.

1.06 GUARANTEE

- A. The Contractor shall guarantee all materials and workmanship under this contract for a period of one year from date of final acceptance, as defined by the Architect, of his work and shall repair and replace any such defective materials and workmanship without cost to the Owner.
- B. The Contractor shall guarantee all equipment be of the quality and capacity specified.
- C. The Owner shall be responsible for routine maintenance such as, oiling, greasing and changing of filters during the warranty period under the Contractor's instructions. Contractor shall furnish the Owner a list of routine maintenance items and shall inspect the project and report to the Architect, in writing, if Owner maintenance is not being performed.

1.07 WARRANTIES

- A. Refer to DIVISION 01 – GENERAL REQUIREMENTS for procedures and submittal requirements for warranties. Refer to individual equipment specifications for specific warranty requirements. Compile and assemble the warranties specified in the "PLUMBING WORK" into a **separated** set of vinyl covered and suitable three ring type permanent binders, tabulated and indexed for easy reference. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond, duration of warranty or bond, and names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.08 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide three copies of typewritten system operating instructions and three copies of operating and maintenance brochures for each piece of equipment including manufacturer's descriptive bulletins with wiring diagrams, parts lists and specific lubricating and maintenance instructions. Brochures shall be bound in suitable vinyl covered, three ring type permanent binders, tabulated and suitably indexed.
- B. In addition, provide a digital copy of all operating instructions and operating and maintenance brochures (in PDF format) all as specified above.

PART 2 - PRODUCTS

No products are specified under this section of the Specifications.

PART 3 - EXECUTION

3.01 REVIEW OF EQUIPMENT AND MATERIALS

- A. Within fifteen days of award of the contract, the Contractor shall submit a digital copy (PDF format) of manufacturers' data and descriptive literature and drawings for all equipment and materials. All literature and data on all equipment shall be submitted at the same time: this material shall contain complete capacity data, curves, dimensions and all other pertinent information necessary for the Architect to properly evaluate the item. No item of equipment or material shall be placed on order until Final Review comments are received from the Architect. In the event the Contractor submits equipment requiring revisions to others work, including but not limited to electrical service or structural supports, other than that shown in the Drawings and Specifications, the Contractor shall bear all costs of the necessary revisions.

3.02 COORDINATION OF TRADES

- A. Where work is in close proximity to the work of other contractors, the Contractor shall review plans of other contractors and coordinate his work with theirs. The Contractor shall verify the location of lighting fixtures, beams, conduit, pipes, ductwork and other obstructions before beginning his work in the area. Notify the Architect where proper clearances do not occur or where the work of others would interfere with the safe and/or proper operation of this work.

3.03 START-UP AND INSTRUCTIONS

- A. The Contractor shall furnish qualified personnel to start-up the installation and to train the Owner's operator in operation of the system.

3.04 SITE CONDITIONS

- A. The Contractor shall visit the building site to determine existing conditions and shall be held responsible for allowing for these conditions in his bid. This will include above or below grade items that may affect the work.

3.05 EXISTING BUILDING CONDITIONS

- A. Note that this area of work has existing mechanical and electrical systems located within the building. It is part of this work for the Contractor to determine the scope and location of all existing systems and the scope and location of all new systems to be installed concurrent with this project and to arrange his work around others.
- B. Contractor shall inspect all existing conditions and space limitations at the site and shall include in his bid all required special adjustments because of site conditions. Verify conditions during construction before fabrication of system components. Early fabrication will not be justification for extra payments for changes due to job conditions.

3.06 SALVAGEABLE MATERIALS

- A. The Owner shall have priority for the selection of the salvageable materials and equipment from the building. Any equipment and materials selected to remain the property of the Owner shall be removed and delivered to a location on the building site as designated by the Architect. All other materials shall be legally and properly disposed of. Provide written documentation, receipts and information indicating the materials, disposal site and date.

3.07 SHUT DOWN OF EXISTING SERVICES

- A. Where existing plumbing systems are to remain operational during construction, all interruptions of such systems shall be held to a minimum. Coordinate outages using a written request to the Architect through the General Contractor. Request shall be submitted to Architect at least 72 hours prior to outage time requested.

END OF SECTION

SECTION 220010 - PLUMBING BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 LABELS

- A. Provide a label on each piece of apparatus and each controlling device. Labels shall identify item and number and have identifying function and position settings. Labels shall be pressure sensitive adhesive mount type, 1/16 inch minimum thickness, engraved type laminated plastic, black with white lettering.

1.02 PIPING IDENTIFICATION

- A. Provide markers on piping which is either exposed or concealed in accessible spaces, with Seton Setmark, EMED Co. Kwik Koil, or equal plastic snap-around markers. For insulated piping, markers may be Seton Opti-Code, EMED Co. Econo Mark pressure sensitive vinyl markers with matching self-adhesive "arrow" banding tape applied circumferentially at each end of marker. For piping system, other than drain and vent lines, include generic name of system or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50 feet maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required. Markers shall comply with ANSI A13.1 Standard.

1.03 VALVE IDENTIFICATION

- A. General: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment unit and faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide shape-coded and stamped brass tags on chain or S-hook fasteners. Tags to be 0.032 inch thick brass with minimum 1/4 inch high letters.

1.04 VALVE SCHEDULE

- A. For each piping system, on standard-size bond paper, tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed or modulating) and variations for identification. Each schedule shall be framed in an extruded aluminum frame suitable for mounting on masonry walls. Mount in equipment rooms or as directed by the Architect.

1.05 MATERIALS IN AIR DUCTS AND PLENUMS

- A. No plastic or other non-metallic materials as defined by NFPA 90A shall be used in air ducts or plenums unless specifically rated for such service.

PART 2 - PRODUCTS

2.01 MOTORS AND MOTOR STARTERS

- A. Electric motors with characteristics as shown on the Drawings shall be provided by the Contractor for all pieces of driven equipment. Electric motors shall be submitted for approval and shall conform to the following: Single phase motors shall generally be as recommended by the manufacturer of the driven equipment. Three phase motors shall be squirrel-cage

induction type motors unless otherwise specified. Motors shall have characteristics as listed on the Drawings and shall be selected to be non-overloading and capable of normal scheduled operation without requiring operating in the service factor range. Motors shall be designed for a 40°C rise from 40°C ambient and shall have NEMA design B normal starting torque unless otherwise specified. Enclosures shall be open, drip-proof for all applications not exposed to outside weather conditions and totally enclosed, fan-cooled for motors located outside, or exposed to outside conditions. All motors shall be rated at full load conditions and be high efficiency, high power factor type, copper wound, premium grade, and shall comply with the Louisiana Building Energy Conservation Code and based on the 2021 IECC with all addenda and Louisiana amendments. Motor shall comply with Energy Independence and Security Act (EISA) of 2007 (NEMA MG-1 Tables 12-1 and 12-2).

- B. Motor starters for factory assembled units shall be provided for by the manufacturer and be completely factory wired and mounted. All contactors to be NEMA rated and generally conform to the specifications below. All separate motors and motors not otherwise packaged with a starter unit as part of a factory assembly shall have a starter as specified below. Provide labels for each starter: white etched letters on black laminated plastic base.
- C. Manual starters for single phase motor applications shall be magnetic start type with operating pilot light, thermal melting alloy overloads, one per phase, Square D Type 3536, Allen-Bradley Bulletin 509, Cutler-Hammer Freedom Series, General Electric CR101, Siemens-Furnas 14 Series or equal as listed by addenda.
- D. Where starters for single phase motor applications call for magnetic type starters, they shall be full voltage, non-reversing combination magnetic motor starter disconnect type with adjustable trip motor-rated circuit protector. Starter shall be NEMA rated and shall have a thermal melting alloy overload, one per phase, operating pilot light and shall have auxiliary contacts as required for interlocking. Any and all indicating pilot lights, diagnostic lamps, etc. shall be LED type with color as standard; do not use incandescent lamps. Overload relays shall be NEMA Class 10 for HVAC compressor use, Class 20 for fan and pump use and Class 30 for high starting torque use. Units shall be Square D Class 8539 with motor logic Class 9065, Cutler-Hammer Freedom Series with CEP7, Siemens-Furnas Class 14 Series, with ESP 200, General Electric CR101 Series, Cerus BAS-1P Series or equal as listed by addenda.
- E. Each three phase electric motor shall be provided with a full voltage non-reversing combination magnetic motor starter disconnect type with adjustable trip motor rated circuit protector unless noted otherwise on Drawings as furnished elsewhere. The starter shall be NEMA rated and have solid state overload relays, one for each leg and shall have a minimum of two each NO and two each NC auxiliary contacts as required for interlocking. Overload relays shall be Class 20 for fan and pump use. Use NEMA Class 30 overload relays only for high starting torque use. Units shall be Square D Class 8539 with motor logic class 9065, Cutler-Hammer Freedom Series with CEP7, General Electric CR387/487 Series Siemens-Furnas 18 Series with ESP 200, or equal as listed by addendum.
- F. Enclosures for combination starters shall be NEMA 1 general purpose for all indoor applications and NEMA 3R rainproof for all applications exposed to outdoor conditions. Provide mechanical operators capable of being locked. Each shall be rated 10K AIC minimum and shall have a hand-off-automatic switch and operating pilot light with push to test lamp feature mounted in the face of the enclosure. Any and all indicating pilot lights, diagnostic lamps, etc. shall be LED type with color as standard; do not use incandescent lamps. Provide fused control voltage transformer 100VA minimum size for 120 Volt or lower coil controls. Unit shall include a factory wiring block for field extension. No wire nut

connections allowed. Verify with Temperature Control requirements. Submit shop drawings on all starters and switches.

2.02 INSULATION

- A. Submittals: Submit product data under provisions of SECTION 220000. For each type insulation system, product data shall identify thermal conductivity, water-vapor permeance, thickness, jackets (both factory and field-applied if any), plus applicable coatings/sealants/adhesives. For each piping system and equipment to be field insulated, provide description (and/or sketches) identifying the insulation system to be installed; this description (for each applicable piping/ductwork/equipment component) shall identify the insulation thicknesses to be utilized, jacketing (if any), coatings/sealants/adhesives, and installation procedures.

- B. All surfaces shall be clean and dry when covering is applied. Covering shall not be applied before piping and equipment have been tested and proven free of leaks. On piping carrying cold fluids, the covering shall pass full thickness through or over hangers and the Contractor shall provide a galvanized steel bearing plate at each support:

<u>Pipe Size</u>	<u>Plate Length</u>	<u>Plate Gauge</u>
Up to 4 Inch	12 Inches	16
5 and 6 Inch	18 Inches	16
8 Inch to 14 Inch	24 Inches	14
Above 14 Inch	24 Inches	12

- C. Plates shall be formed to fit the outside of covering and shall extend halfway around the covering. All plates, sleeves and hanger devices to be sized and applied without damaging or deforming the insulation or puncturing the vapor barrier.
- D. For the purposes of this specification, the term "attic" refers to the cavity space between the roof deck and the insulation level at the ceiling line. If all of the insulation is at the roof level, with no insulation at the ceiling line, then the cavity space is not an attic.
- E. Unless indicated otherwise, all insulation installed within the building enclosure(s) shall have a composite (insulation, jacket and adhesive, as applicable) flame spread index of 25 or less and a smoke-developed index of 450 or less, unless required otherwise by local Codes and International Building Code 720. Insulation within air ducts, plenums or other similar compartments used as part of an air distribution system shall be of materials approved for plenum service and shall have a flame spread index of 25 or less and a smoke-developed index of 50 or less, as per NFPA 90A and International Mechanical Code 602. Plastic materials are not allowed in plenum spaces unless specifically rated for such service.
- F. For horizontal runs of above grade waste piping carrying cold fluids (such as drains from HVAC cooling coils, coolers/freezers, or ice makers/dispensers), insulate with flexible elastomeric cellular (foam) insulation applied by the slip on method with glued and sealed joints. Insulation shall be 3/4" thickness. Where routed within a return air environment, insulation shall have an acceptable composite flame and smoke rating.
- G. Unless indicated otherwise, all interior rainwater piping shall be insulated with 2 inch thickness 3/4 pound glass fiber blanket with glass fiber reinforced aluminum foil vapor barrier. Staple joints and apply pressure-sensitive tape (matching the insulation facing and designed for use with the insulation) all around joints and at longitudinal seams. Piping that is not concealed above ceiling space or concealed within wall/chase/furring spaces shall be covered with 1

inch thickness, 4-pound density molded glass fiber pipe insulation with factory applied vaporproof flame bar jacketing; include PVC outer jacketing on piping within 8'-0" of finished floor.

- H. Insulate all domestic hot water piping except exposed runouts at fixtures, with molded glass fiber pipe insulation with all-service (ASJ) factory applied vaporproof flame bar jacket (adhesive applied) or pre-slit/pre-glued flexible elastomeric cellular (foam) molded insulation with peel-off adhesive. Insulation shall be 1 inch thickness for all piping. Domestic cold water piping at inlet to water heaters shall be insulated same as specified for domestic hot water piping; insulation shall extend from inlet of heater to inlet of piping (in-line) heat trap. Except as indicated above for water heaters, domestic cold water lines in attics, outside walls, and unconditioned equipment spaces shall be insulated same as specified for domestic hot water, except may be 1/2 inch thickness. Insulate all such fittings with molded fitting sections to match or with fire rated plastic fitting cover sections filled with glass fiber. Plastic fitting covers shall not be used in plenum spaces. Provide bearing plates, same as specified above, at hangers for insulated domestic water piping larger than 3/4 inch diameter.
- I. Except for piping insulated with flexible elastomeric cellular (foam), all domestic water piping systems within mechanical rooms shall be covered with PVC jacketing in addition to the "factory applied vaporproof flame bar jacket." Piping concealed within wall space or concealed above ceiling is not required to have PVC jacketing. PVC jacketing shall be 0.020 inch minimum thickness applied with approved PVC adhesive over all seams; fill any unavoidable openings in jacketing with silicone sealant. Jacketing shall be 25/50 Flame/Smoke Rating as per ASTM E-84. Generally jacking shall be white color except where color code jacking is required per Paragraph 1.3.B of this Specification Section 220010; color code selection of jacketing shall be chosen by the Architect based on jacketing manufacturer's standard color chart, and the color for fitting covers is to match that for straight pipe sections.
- J. For (above ground) domestic water piping exposed to outdoor environments, insulate with 1 inch thickness flexible elastomeric cellular (foam) insulation applied by the slip-on method with joints glued and sealed.
- K. For piping exposed to outdoor environments, insulation shall be covered with outer jacketing of multi-ply zero permeable embossed aluminum sheeting material (nominal 7 MILS thickness), VentrueClad 1577 CW Series, Ideal Tape Co., Inc. IdealSeal 777, Polyguard Alumaguard or Alumaguard LTE Series or equal as listed by addendum; install sheeting material in accordance with manufacturer's installation requirements.
- L. Acoustical Pipe Lagging: Where noted on drawings to provide Acoustical Lagging, pipe lagging shall be a 2 lb. psf mass loaded vinyl noise barrier with a reinforced foil facing on one side, bonded to a 2" thick non-woven porous scrim faced quilted fiberglass decoupler on the opposite side 1. Products I. Model # B-20 LAG/QFA-9 as manufactured by Sound Seal which is in Agawam, MA, USA (www.soundseal.com). The lagging shall be nominally 2" thick, shall have a nominal density of 2.0-lb/cu. Ft, and shall be quilted with a non-woven porous scrim facing. 5. The lagging shall have a Class A flammability rating, Flame Spread Index less than 15, and a Smoke Density less than 20. Install lagging in accordance with manufacturer's installation instructions (for each application) and provide all installation accessories necessary for securely mounting the lagging, including but not limited to foil lagging tape, insulation stick pins, insulation welding pins, and insulation Banding. The Sound Transmission class shall be STC 29. The Acoustical Performance Sound Transmission Loss shall be per ASTM E 90 with Octave Band Center Frequency (Hz) performance as follows:

<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>
21	24	29	41	.54	68

- M. Insulation materials shall meet the following minimum standards:
1. Fiberglass piping insulation: ASTM C 547, CLASS 1, 0.25 K-factor at 100°F mean temperature.
 2. Flexible elastomeric cellular insulation: ASTM C 534, TYPE I (for Piping), ASTM C 534, TYPE II (for Sheets)
- N. Insulating materials shall be as made by Dow, Knauf, Owens-Corning, Pittsburgh Corning, Johns Manville, Armstrong, Nomaco, or equal as listed by addendum, and shall be installed as per manufacturer's requirements.

PART 3 - EXECUTION

3.01 INSULATION INSTALLATION

- A. Insulation Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program for the insulation products to be installed. Installers for an insulation product may be skilled mechanics who have successfully completed an insulation product manufacturer's installation training program for that product, (such as the Armacell Qualified Installer Program) and have been given a certificate of completion from that product manufacturer. The insulation installer must be licensed in the state of Louisiana by the State Licensing Board of Contractors in the classification of Specialty Insulation (Commercial and Industrial) or have a minimum of 5 years' experience in the field of Commercial Insulation.
- B. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.
- C. Install insulation materials, accessories, and finishes in accordance with manufacturers installation instructions for the intended applications, with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Install insulation continuously through hangers and around anchor attachments.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers,

supports, anchors, and other projections with vapor-barrier mastic. Also, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic

- L. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- M. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- N. Except where required otherwise by the manufacturer's installation instructions, install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on centers.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
 - 6. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
 - 7. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
 - 8. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.
- P. General pipe insulation installation requirements:
 - 1. Requirements in this article generally apply to all insulation materials except where more specific requirements are noted above or by the manufacturer's installation instructions.
 - 2. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - a. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - b. Insulate pipe elbows using preformed fitting insulation or mitered fittings

made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

- c. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - d. Except as noted above for chilled water and heating water piping valves, insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - e. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - f. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - g. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
3. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
 4. For flexible elastomeric cellular (foam) piping insulation, install insulation system in accordance with manufacturer's installation instructions and ASTM C 1710, plus the following:
 - a. Slide un-slit sections over the open ends of piping or tubing; (slide on) insulation shall be pushed onto pipe, not pulled. Alternatively, slit tubular sections and apply onto piping or tubing; slit tubular insulation shall be installed with longitudinal seams at top of horizontal runs.
 - b. Insulation shall be mitered, pre-adhered and longitudinally slit inside throat to fit over all tees and elbows or bends over 90°.
 - c. All butt joints and seams shall be adhered with full coverage of adhesive on both surfaces. Insulation shall not be stretched when adhering. Do not tape insulation joints.

- d. At the beginning, at every 12 to 18 feet, and at the ends of piping runs, the insulation shall be adhered directly to the copper using a 2" strip of adhesive. Insulation should not be adhered to the pipe at the extreme low points in any piping run.

3.02 SUPPORTS, FOUNDATIONS AND VIBRATION ISOLATION

- A. The Contractor shall, unless otherwise specified, provide all foundations, supports, etc., necessary for properly supporting his work and equipment furnished by him and shall furnish and install all isolation materials to prevent transmission of vibration to the building structure. Isolation of equipment as shown on Drawings is the minimum required and any additional isolation required to prevent transmission of vibration or sound shall be provided by the Contractor, in accordance with the equipment manufacturer's requirements. All floor mounted equipment shall have a 4 inch high minimum housekeeping concrete pad with 1 inch chamfered edges. For indoor slab mounted equipment, vibration isolation is required for all vibrating or rotating equipment.
- B. Where applicable, under no circumstances is the Contractor to attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems shall be approved by the Architect. All supplemental angle or channel iron required to support equipment of this Specification shall be furnished by the Contractor and shall be independent of any other supports.
- C. Supports for piping, conduit and equipment exceeding 200 pound load suspended from overhead construction in concrete shall incorporate steel imbedded anchors into the concrete pour. Use stainless steel expansion anchors only for loads less than 200 pounds per anchor and only in non-post tensioned slabs. For post tensioned slabs use imbedded support plates only.
- D. For slab mounted equipment, provide rubber mounting pads at each corner and under the support rails. For suspended units, provide combination rubber and captured spring isolators at each suspension point under the support base. Size and configuration shall be as required by the manufacturer for the use intended.

3.03 OPENINGS, CUTTING AND PATCHING

- A. Cut all openings as required for the work under this subcontract. Patching shall be done by the various crafts whose work is involved. Furnish and install all necessary sleeves, thimbles, hangers, inserts, etc., at such times and in such a manner as not to delay or interfere with the work of other contractors. Seal, caulk and otherwise make air tight all pipe penetrations through walls and floors. Caulk, flash or otherwise make weatherproof all penetrations through the roof and exterior walls. No pipe opening shall be sealed around the pipe or insulation without the penetration isolated from the wall system.
- B. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- C. For all openings larger than 16 inches horizontal dimension in existing masonry walls, provide 3 inch x 6 inch x 1/4 inch steel angle lintel with 8 inch minimum bearing length extending beyond each side of opening.

- D. Where required, all openings shall be protected by a rated protection system listed for the specific application for the type of material penetrating the fire barrier and the type of construction of barrier penetrated. Sealants used in floor penetrations shall be waterproof.
- E. Where piping or other items, that are provided for under this contract, penetrate fire rated walls or floors, the Contractor shall seal around the item to maintain the integrity of the rated system. All openings shall be protected by a rated protection system listed for the type of material penetrating the fire barrier and the type of construction of barrier penetrated. Sealants used for floor penetrations shall be waterproof. Systems shall be UL rated for two hours minimum. Submit for system proposed for review. Provide documentation to the General Contractor and Architect for each type fire protection sealing system utilized in this project. The Fire Marshal Inspector may perform random destructive sampling of the sealant system installation; Contractor shall repair seal at sampling locations.
- F. For openings containing non-metallic material, piping, conduit or wiring, and penetrating a floor-ceiling assembly, the system shall include intumescent material and shall be a listed "through penetration" assembly tested in accordance with ASTM E-814.

3.04 ACCESS PANELS

- A. Access panels in ceilings and walls shall be steel doors with heavy duty concealed hinges of the pinless type and screw driver locks. Doors shall be prime coat finish.
- B. Provide access panels in the ceilings and walls for valves, etc. These access panels are for installation by others, but the Contractor is responsible for their proper location.
- C. Access panels in fire rated ceiling/walls shall be UL labeled to meet the requirements of the rated assembly and shall have a closer device to automatically close and latch the door upon release from any open position. Fire rated access panels shall have key operated locks with spare set of keys (turn over to Owner).
- D. Where lay-in ceilings exist, no access panels are required.

3.05 CLEANING AND STERILIZATION

- A. When all work has been finally tested, clean all fixtures, pipes and exposed work. All pipes shall be free of all obstructions. Thoroughly clean and polish all plated and other finished products.
- B. All new piping, vessels and heat exchangers in the project shall be thoroughly flushed of all debris and foreign objects with appropriate fluids before systems are placed in operation. After flushing, all strainers and dirt traps shall be checked and cleaned.
- C. All new potable water piping systems shall be thoroughly sterilized with a solution containing 50 mg/L of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hypochlorite solution. The sterilizing solution shall be allowed to remain in the system for a period of six hours or longer, during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 ppm. All work shall meet requirements of applicable codes.

END OF SECTION

SECTION 220020 - PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install in a neat, workmanlike manner all piping shown on Drawings or that is specified or required to provide a complete, properly operating installation.
- B. Where pipe or equipment shall be insulated, extend all grease and oiling fittings from equipment to locations outside of insulation and provide rigid supports.
- C. The Contractor shall provide small ready fire extinguisher at all welding and cutting operations indoors.
- D. All potable (domestic) water piping (including fittings and piping accessories in contact with potable water) and materials that join or seal piping shall conform to ANSI/NSF 61. All piping, plumbing fittings (and fixtures), solder and/or flux used in the installation or repair of any potable (domestic) water piping shall meet the "lead free" requirements of the Plumbing Code.
- E. All plastic water piping shall conform to ANSI/NSF 14.
- F. All building services piping defined by ASME B31.9 (including, but not limited to gas, compressed air and vacuum piping) shall comply with the current edition of ASME B31.9 "Building Services Piping" for materials, products, fabrication, installation and testing of piping systems.

1.02 SERVICE CONNECTIONS

- A. All connections to services shall be verified by the Contractor. Where costs for service connections are incurred, the Contractor shall include these costs in his bid.

1.03 TESTING

- A. Test all piping and prove tight to the satisfaction of the Architect before covering is applied, or fixtures connected.
- B. Notice shall be given to the Architect and to the plumbing inspector before the tests are made, and the test shall not to be drawn off the pipes and pipes shall not be covered or insulated until the filled pipes have been examined and the testing approved by the Architect and inspectors.
- C. For all domestic (potable) water supply systems, cap and subject piping to static water pressure in accordance with the Plumbing Code.
- D. For all non-potable water and compressed air piping systems, cap and subject piping to static water pressure test that is not less than the greater of 125 psig or 50 psig above the operating pressure (without exceeding the pressure rating of piping system materials). Isolate test source and allow it to stand for four hours.

- E. Leaks and loss in static water pressure tests constitute defects that must be repaired. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained
- F. After all drainage (soil, waste, and rainwater) lines and vent lines have been set, all the outlets shall be temporarily plugged up. The pipes shall be filled with water to the point of overflow, but not less than 10-foot head of water. Allowed water fill test to remain for 24 hours and inspect for leaks. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained. In addition to the above testing criteria, testing of all drainage and vent systems plus all building sewer systems shall be in accordance with the Plumbing Code.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide materials necessary to accomplish the installation of the piping systems.

PART 3 - EXECUTION

3.01 PIPE JOINTS

- A. Threaded joints shall be American Standard taper pipe threads made up metal-to-metal with a thread lubricant. No hard setting pipe thread cement or caulking will be allowed. Cut threads so that a maximum of three threads remain exposed after the fitting is made up. Ream all pipe ends after cutting and clean before erection.
- B. Make up copper piping joints with soldered joints using sweat type fittings. Cut pipe square and remove all burrs before assembly. Carefully clean and solder pipe and fittings with solder containing 95% tin and 5% antimony using non-corrosive flux. Solder or fluxes used shall not contain lead or lead compounds. The Contractor may, at his option, braze joints in copper piping using silver solder, phos-copper, silphos, or other high temperature brazing alloy approved by the Architect. Solder used for potable water systems shall be lead free.
- C. Make plastic pipe and pipe fitting joints as per the requirements of the manufacturer using joining methods and materials in strict accordance with all applicable standards. Generally, make joints using proper materials, properly prepared and complying with all required procedures and techniques regarding cleanliness, dryness, temperature, physical alignment and all other pertinent precautions. Gasketed joints shall have beveling at spigot ends and shall be cleaned then lubricated (as per manufacturer's instructions) prior to inserting ends. Where PVC piping is allowed by the project's documents for potable (domestic) water systems, all solvent cements and primers used to join and seal PVC materials shall comply with the requirements of ANSI/NSF 14, as per the Plumbing Code.
- D. In addition, follow all recommended procedures for solvent welded joints including but not limited to the following.
 - 1. Cut the pipe square and properly deburr and bevel.
 - 2. Follow all manufacturer's requirements providing the separate steps of cleaning, priming and cementing.
 - 3. Use purple primer so that use can be clearly observed.
 - 4. Use an appropriate number of workers for required procedures and timing.

- E. For above slab domestic water copper piping, tee connections may be mechanically formed branch collars as listed by the National Standard Plumbing Code, Standard Building Code Congress (S.B.C.C.) and UL, and complying with ASME Code for pressure piping ANSI B31.5c. The lap joint collar shall be mechanically formed by drawing out the tube surface to form a raised collar to accept the branch tube. The branch tube shall be notched to insure proper penetration of the branch tube into the collar. Mechanically formed joints shall be brazed in accordance with manufacturer's approved methods using BCuP Series filler metal, no soft solder joints.
- F. Welded Joints/Procedures:
1. Make welded joints by the metallic arc or gas welding process in accordance with current version of American Welding Society (AWS) D10.12M/D10.12. Welding electrodes shall have coating and diameter as required by the manufacturer for the type and thickness of work being done.
 2. The preferred method of field cutting piping shall be with a band saw or abrasive wheel with the cut edge perpendicular to the length of the pipe. Pipe cuts using hand torch methods may be utilized provided the torch cutting process occurs at a location exterior of the finished building, the rough edges of the torch cut pipe is prepared for welding by field grinding and the root opening tolerances of the weld joint is maintained.
 3. All pipe ends for welding shall be beveled. Machine beveling in shop is preferred. Field beveling may be done by flame cutting or grinding to recognized standards; however flame cutting shall occur at the exterior of the finished building. The bevel angle shall be uniform and shall be approximately 37° leaving a 1/8" high face at the inside edge of the pipe.
 4. Pipe sections to be welded shall be aligned such that the surfaces to be joined are parallel to each other, and the groove to be welded is uniform and approximately 75° wide. The root of the pipe shall be separated no more than 1/8".
 5. The root shall be welded in a single pass with the rod perpendicular to the center line of the pipe.
 6. The groove remainder shall have a series of fill welds to cover the height of the groove. Each fill weld shall be a single pass and shall be repeated until the groove is filled.
 7. The final weld shall be a corner weld, single pass covering the full width of the welded joint.
 8. All welds shall be uniform in width and depth and free of cracks, holes, sputter points, cold laps and points and gouges in the pipe wall.
 9. All fittings in welded piping shall be factory-fabricated seamless welding fittings conforming to ANSI B16.9 and constructed of the same material and weight (or schedule) as the piping attached. Where the size of a branch take-off does not exceed 2/3 of the diameter of the main to which connected and the main is 2-1/2" diameter or larger, branch take-offs may be made with factory fabricated "O-LET" fittings, to match the class of fabrication.
 10. Welds found not complying with the above methods or otherwise appear to employ poor workmanship shall be selected by the Architect for X-ray analysis with the cost borne by the Contractor. Unsuitable welds shall be removed and, using new pipe, remade.

3.02 SLEEVES AND PLATES

- A. Wherever pipes pass through concrete or masonry walls or structural slabs, furnish and install sleeves, properly located for the work. Where pipes pass through monolithic concrete floors, omit sleeves and use double wrap of 15 pound tarred felt.
- B. Sleeves shall be of sufficient size to allow the specified pipe covering to pass through the sleeves. Finish flush with floors where exposed to view in finished areas of the building, 2 inches above floors where in equipment rooms and furred spaces and 6 inches above roofs. Seal all spaces between sleeves and pipes or pipe coverings. Use method as described under 220020 - OPENINGS, CUTTING AND PATCHING or ceramic fiber packing or a mechanical device for fire rating to match wall or floor.

3.03 ESCUTCHEONS

- A. Where pipes passing through walls, floors and ceilings are exposed to view in finished areas of the building, provide nickel plated pressed steel split floor and ceiling plates which shall cover the opening and fit snugly to the pipe or covering.

3.04 ACCESS PANELS

- A. Provide access panels in ceilings and walls where required for access to valves and other devices. Access panels shall be as specified under 220010 – PLUMBING BASIC MATERIALS AND METHODS. Where lay-in ceilings exist, no access doors are required.

3.05 PIPE SUPPORTS

- A. Support pipe carrying cold fluids in hangers which allow the pipe covering to pass full thickness through the hanger. Install metal saddles as specified under 220010 - INSULATION to protect the covering.
- B. In general, suspend horizontal runs of pipe from the overhead construction using steel clevis type, band type or split ring malleable iron hangers, suitable for the pipe size and weight. Anchor hanger rods to building construction using beam clamps, inserts, weld clips, drilled bolts and nuts, etc. Any straight up nails, wood bolts or concrete expansion shields will not be allowed. Verify final exact hanging arrangement with the Architect. See Drawings for additional support information. Size rods as follows:

<u>Pipe Size, Inches</u>	<u>Rod Diameter, Inches</u>
2 and Smaller	3/8
2-1/2 and 3	1/2
4	5/8
6 - 8	3/4
10 - 12	7/8

- C. Where two or more pipes run parallel and at the same location, they may be supported on channel or angle iron trapeze hangers, suspended from the overhead construction by rods same as specified for single hung pipe, except that the hanger rods shall be increased in size to support the additional weight. Thread lower ends of hanger rods 2 inches for adjustment and provide with nuts at top and bottom of channels. Upon completion of work, cut the rods off to present a neat appearance.

- D. For hangers supporting bare (unprotected) copper piping, provide factory manufactured hanger ring/clamp with integral isolation material to minimize noise transfer and damage from abrasion. The isolation material shall be designed specifically for the application and shall be met ASTM E-84 25/50 flame/smoke rating for plenum environment.
- E. Unless otherwise specified herein or on Drawings, space hangers for steel pipe at not more than 5 feet for pipe 1 inch and smaller and at not more than 10 feet for pipe 1-1/4 inches and larger. Support copper tubing at intervals not exceeding 8 feet. Support plastic pipe at intervals one third closer than for steel pipe.
- F. Support horizontal suspended cast iron pipe at intervals not exceeding 10 feet with at least one hanger for each pipe section and with hangers located not more than 18 inches from the joints. Also, provide hanger at terminal end of horizontal runs/branches and each change of direction. For each floor outlet water closet, "closet" bends shall be firmly secured/restrained.
- G. Support cast iron, steel or copper piping at each floor penetration.
- H. Plumbing piping shall be supported in accordance with local code requirements.
- I. Drain and rainwater risers shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents, but in no case less than at every floor level.
- J. Provide supports and anchors for all pipe in horizontal or vertical position as required for installation satisfactory to Architect.
- K. For application where plumbing piping must be installed to route through metal studs in order to serve plumbing fixtures and/or equipment, provide factory manufactured metal stud (acoustical) isolator at each such piping penetration through metal studs. Metal stud isolators shall meet ASTM E-84 25/50 flame/smoke rating for plenum environment, similar to Sioux Chief 558 Series or Hubbard Enterprises/Holdrite 424 Series.

3.06 PIPE FLASHINGS

- A. Where pipes extend through roof or outside walls, use flashings as required for weatherproofing. Roof flashings shall be lead with minimum 10 inch turnout and rolled into top of pipe. Wall flashings may consist of suitable caulking.
- B. For metal panel roofing systems, flashings shall be T.W. Buildex Dek Tite, The Pate Co. Pipe Flashing Device, or equal, conical shaped, long life E.P.D.M. rubber stepped boot assembly with flexible aluminum base ring. For conforming to contour of metal roofing panel, provide required sealant caulking, self-sealing fasteners and accessories necessary for installation in accordance with manufacturer's requirement to provide a weather-tight/rain-tight installation.

3.07 PIPING INSTALLATION

- A. Run piping parallel with lines of the building, unless specified or noted otherwise. All pipe shall have minimum one-half inch clearance from other work, including coverings.
- B. Slope horizontal soil and waste pipes 1/4 inch per foot for pipes 2 and 3 inches in size and with a minimum fall of 1/8 inch per foot for pipes 4 inches and larger. Where an end or circuit vent pipe from any fixture or line of fixtures is connected to a vent line serving other

fixtures, make the connection at least four feet above the floor on which the fixtures are located or above the flood plain of the highest fixture on the floor level.

- C. Grade horizontal drain piping downward in the direction of flow at least 1/4 inch per foot wherever possible but in no case less than 1/8 inch per foot.
- D. Make all changes in pipe size on soil, waste and drain lines with reducing fittings, recessed reducers or flush bushings.
- E. Make all changes in direction by the appropriate use of long radius fittings, except that sanitary tees may be used on vertical stacks and short quarter bends or elbows may be used in soil and waste lines where the change in direction of flow is from horizontal to vertical. Where it becomes necessary because of space conditions to use short radius fittings in any other location, obtain the consent of the Architect before they are installed.

END OF SECTION

SECTION 220030 - PLUMBING PIPING MATERIALS

PART 1 - GENERAL

1.01 SCOPE

- A. Piping within air ducts, plenums or other similar compartments used as part of an air distribution system shall be non-combustible or have a flame spread of not over 25, and shall have a smoke developed rating no higher than 50; no plastic piping is allowed in such spaces unless specifically rated for such service.
- B. All steel pipe shall be in accordance with the "American Standards for Wrought Steel Pipe." Piping materials shall be in accordance with the following.

PART 2 - PRODUCTS

2.01 DOMESTIC COLD WATER, HOT WATER & HOT WATER RETURN PIPING

- A. Piping shall be Type "L" hard drawn copper with wrought copper sweat fittings.

2.02 SOIL, WASTE AND VENT PIPING

- A. Service Weight, bell and spigot cast iron pipe and fittings conforming to ASTM A74 with neoprene gasket conforming to ASTM C564. Joints shall be made in accordance with manufacturer's requirements (CISPI Handbook). Piping above grade may be hub less cast iron pipe and fittings conforming to CISPI 301. All cast iron soil pipe and fittings shall be marked with the collective trademark of the cast iron soil pipe institute (CISPI) and be listed by NSF International.
- B. Joints for no hub pipe and fittings shall conform to the manufacturer's installation instructions and local Code requirements. No hub couplings shall be composed of a stainless steel shield, clamp assembly and an elastomeric sealing sleeve conforming to CISPI 310. **For soil and waste piping, no hub couplings shall be Husky SD 4000, Tyler High Performance Wide Body Mission heavyweight couplings, or equal heavy-duty type with four stainless steel bands for piping 1-1/2 inch diameter to 4 inch diameter, and with six stainless bands for piping 5 inch diameter to 10 inch diameter, complying with the current version of ASTM C 1540.**
- C. Where space limitations restrict the use of cast iron piping, waste piping may be DWV type copper tube ASTM B306 with cast bronze drainage pattern fittings with soldered joints. (Not applicable for waste from urinals or water closets.)
- D. Underslab and under grade piping may be solid-wall, schedule 40 PCV with appropriate bedding material as required by manufacturer. PVC not allowed in plenum spaces.

2.03 EQUIPMENT DRAIN PIPING

- A. Condensate drains from evaporators shall be Type "L" hard copper with wrought copper fittings. Drains shall be 1-1/2 inch minimum size. For ice maker bin drains, material may be Schedule 40 PVC plastic pipe and fittings; see "SCOPE" in "PART 1" of this section of the Specifications. Drains from other equipment and piping system points shall be Schedule 40 galvanized steel.

2.04 RAIN WATER PIPING

- A. Interior piping and piping under building shall be coated Service Weight, bell and spigot cast iron with neoprene gasket joints.

2.05 FITTINGS

- A. Screwed fittings shall be fine grain full weight malleable cast iron as specified, with smooth cut tapered threads. Welded fittings shall be seamless steel full standard weight. Mitered ells or notched tees will not be allowed. Where pipe 2 inches and smaller tees into pipe 2-1/2 inches and larger, threaded or welded saddle fittings may be used for tees where the branch size is not more than one-half the main size.
- B. Companion Flanges 2-1/2 inches and larger shall be 150 pound forged steel slip-on or welding neck type with raised face. Companion flanges 2 inches and smaller shall be standard 125 pound cast iron, screwed pattern. Flange bolts and nuts shall conform with ASTM A307, Grade B. Gaskets shall be suitable for the service intended.
- C. PVC pipe threaded connections larger than 1 inch shall be male threaded fittings; not female thread. When connecting PVC piping to metallic piping or fittings, Contractor shall use plastic male thread into a metallic female thread.
- D. Copper pipe fittings shall be sweat type made up as described under "PIPE JOINTS" in Section 220020.
- E. Plastic fittings shall be made as described under "PIPE JOINTS" in Section 220020.

2.06 FLEXIBLE PIPE CONNECTIONS

- A. Provide flexible pipe connectors where shown on Drawings. Unless otherwise approved by Architect, connectors shall be flanged, 125 psig WOG and fabricated with stainless steel bellows and braided cover, length three times the pipe diameter.

2.07 DIELECTRIC FITTINGS

- A. Provide dielectric fittings with appropriate end connections for pipe materials in which to effectively isolate dissimilar metals (including copper to steel connections), to prevent galvanic action and stop corrosion. For water (liquid) piping systems 4 inch diameter or less, dielectric fittings shall be Victaulic Clearflow Style 47, Precision Plumbing Products Inc. (PPP) Clearflow, or equal as listed by addendum, dielectric piping "nipples" with inert thermoplastic lining. For water (liquid) piping systems larger than 4 inch diameter, dielectric fittings shall be same as specified below for air/gas piping systems (larger than 2 inch diameter). For air/gas piping systems 2 inch diameter and smaller, dielectric fittings shall be dielectric unions with isolating gasketing/seals, Watts 3000 Series, Legend T-57_ Series, Central (Plastics) Insulating Unions, or equal as listed by addendum. For air/gas piping systems larger than 2 inch diameter, dielectric fittings shall be piping flanges with flange isolation kits (including isolating/sealing gasket, bolt isolating sleeves and isolating washers).

2.08 UNIONS

- A. Install union connections at all pieces of equipment such as coils, pumps, tanks, etc., and all control valves. Where there is a valve at a piece of equipment, locate the union connection on the equipment side of the valve. No union shall be concealed in construction.
- B. Unions installed in sweated copper pipe shall be Crane No. 633, Nibco No. 633 or Grinnell Figure 9730. Unions 2-1/2 inches and larger shall be Grinnell Figure 463, Stockham Figure 698 or Nibco No. 733, standard malleable iron flange union with gasket.

2.9 PIPING ACCESSORIES AND SPECIALTIES

- A. Piping accessories and specialties shown on Drawings or called for in these Specifications shall be in accordance with or similar in style and quality to the following specified equipment. Manufacturer's name and model numbers are mentioned only to establish the style and quality desired.
- B. Provide valved manual air relief points at all locations required to remove air from circulating water systems.
- C. Strainers shall be Y-type with removable bronze screens having 1/8 inch perforations. Provide 3/4 inch blow-down connection with valve.

2.10 BALANCING DEVICES

- A. Furnish and install manual venturi style flow measuring and balancing/shut-off valve combination balancing devices. The flow element shall be a low loss/high signal venturi (3% accuracy) on 1 to 10 range ability, equipped with dual T & P plugs (preferred) or Schrader Type pressure test ports and caps. The permanent pressure loss added to the pumping head for the venturi /valve assembly shall not exceed two feet, at the design GPM in the wide-open position. The entire assembly shall be rated to 200 WOG (minimum) and tested to 100 psig after assembly. With each balancing device, include permanent tag with manufacturer's name, model, size and flow performance data.
- B. Balancing devices shall have brass body venturi with brass or bronze body ball valve. The ball valve shall have a large diameter plated ball, Teflon seats, blow out proof stem with Teflon packing and packing nut, and full size handle operator with memory stop. For chilled water applications, include extended stem valve operator, arranged to receive insulation. Devices shall be Flow Design Inc. (FDI) Model UA, Hydronic Components Inc. (HCi) Terminator B, Nexus Valve Inc. Model XB, Bell & Gossett Model MV or equal as listed by addendum. Install balancing devices in accordance with the manufacturer's instructions.

2.11 RECIRCULATION BALANCING VALVE

- A. Furnish and install on the plans and describing herein, a Caleffi recirculation thermal balancing valve, as manufactured by Caleffi. Each balancing valve must be designed with a DZR low-lead brass body that complies with NSF/ANSI 372, as certified by ICC-ES, file PMG-1360. Complies with NSF/ANSI/CAN 61 (180°F Commercial Hot) as certified by ICC-ES, file PMG-1512. Stainless steel & copper adjustable cartridge, peroxide-cured EPDM seals, ABS adjustment knob. The balancing valve must include 1/2" or 3/4" NPT female connections. Each valve has 230 psi maximum working pressure and 95-140°F adjustable temperature range. Provide with optional outlet temperature gauge with 30-180°F

temperature scale, optional check valve, and optional pre-formed insulation shell. Each valve shall be Caleffi model 1161 or approved equal.

2.12 PRESSURE GAUGES

- A. Pressure gauges shall be Weiss 4CTS-1, Davis Model 1009 (4"), Weksler EA-14, or equal as listed by addendum, and shall have 4-1/2 inch glass dial face, corrosion resistant stainless steel case and ring, balanced adjustable black pointer guaranteed accurate to 1% of range, easy read dial - white background with bold black numerals and graduations, 270 degree arc, 1/4 inch N.P.T. bottom connection. Provide gauge cock (valve) in stem. Pressure range for each gauge is to match the operating pressure range for each specific application, with the normal system operating pressure at the mid-range of the pressure scale.

2.13 THERMOMETERS

- A. Thermometers shall be Weiss 5VBM, Davis PZ156, Weksler 5AA, or equal as listed by addendum, round bi-metallic type with 5 inch dial, stainless steel case, bold black numerals, bold scale graduations and a heavy glass face. Graduations for water, 20 degrees to 160 degrees.

2.14 VALVES, GENERAL

- A. All valves shall have manufacturer's name and working pressure clearly cast on valve bodies. Where underground piping system with gasket/mechanical joint fittings are allowed in this Specification, valves may have mechanical joint connections (complying with AWWA C111). Valves shall have pressure and temperature ratings equal to or greater than the service intended.
- B. Valves 2 inches and smaller shall be 125 psi SWP/200 psi WOG, bronze body (conforming to MSS SP-80), threaded or sweat pattern (use threaded ends for piping joined by brazing methods), as indicated below:
 - 1. Gate Valves (RS): Nibco T/S-111; Milwaukee 148/149; Stockham B-100/108
 - 2. Gate Valves (NRS): Nibco T/S-113; Milwaukee 105/115; Stockham B-103/104
 - 3. Check Valves: Nibco T/S-413; Milwaukee 509/1509; Stockham B-319/309
- C. Valves, 2-1/2 inches and larger shall be Class 125, iron body (conforming to MSS SP-70), bronze trimmed, flanged faced and drilled in as indicated below:
 - 1. Gate Valves (OS&Y): Nibco F-617; Milwaukee F2885; Stockham G-623
 - 2. Gate Valves (NRS): Nibco F-619; Milwaukee F2882; Stockham G-612
 - 3. Check Valves: Nibco F-918; Milwaukee F2974; Stockham G-931
- D. Ball valves 2 inches and smaller shall be Grinnell 3810 Series, Nibco 595-Y Series or Watts B-6800 Series, rated for 150 PSI saturated steam pressure, 400 psig WOG pressure, 3-piece construction, with bronze body conforming to ASTM B 62, conventional port (or full port), chrome-plated brass or stainless steel ball, replaceable "Teflon" or "TFE" seats and seals, blow out proof stem and vinyl-covered steel lever handle, 4 inch minimum length. Ball valves one inch and smaller may be two-piece construction with standard or regular port, Nibco T/S-585-70, Watts B-6080 Series or Stockham S-216-BR-R Series.

2.15 BACKFLOW PREVENTERS

- A. Double Check Backflow Preventer for equipment/appliances: 1/2" to 2" size, Febco LF850 Series, Ames LF2000B Series, Watts LF007 Series, Wilkins 350XL Series or equal as listed by addendum, double check valve assembly complete with inlet/outlet shut off valves and test cocks (with plastic or brass caps). The assembly shall meet the requirements of A.S.S.E. Standard 1015 and shall be U.S.C. approved. The body of the double check valve shall be bronze construction. Provide all accessories and (optional) features as noted on drawings.
- B. Reduced Pressure Backflow Preventer for equipment/appliances: 1/2" to 2" size, Febco LF860 Series, Ames LF4000B Series, Watts LF009 Series, Wilkins 975XL2 Series or equal as listed by addendum, reduced pressure assembly complete with inlet/outlet shut off valves, test cocks (with plastic or brass caps) and relief valve. Include manufacturers air gap drain fitting (with splash shield) to match the assembly. The assembly shall meet the requirements of A.S.S.E. Standard 1013 and shall be U.S.C. approved. The body of the reduced pressure valve shall be bronze construction. Provide all accessories and (optional) features as noted on drawings.
- C. For main service line backflow preventer, refer to Drawing Sheet P0.0, Detail 5 for Specification.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install all equipment, piping and accessories as per manufacturer's recommendation.

END OF SECTION

SECTION 220040 - PLUMBING EQUIPMENT AND SPECIALTIES

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install all equipment as indicated on the Drawings, and specified hereinafter including requirements of SECTION 220000 - PLUMBING GENERAL REQUIREMENTS.
- B. The Contractor shall verify that all equipment and materials provided for the project by him will fit and function within the space allowed. This includes the access to and the arrangement within the space. This requirement may require field breakdown and reassembly of the equipment.

PART 2 - PRODUCTS

2.01 WATER HEATERS - GENERAL

- A. Where applicable, provide for certificate inspection of water heater(s) as required by State Authorities; this inspection is to occur prior to Substantial Completion of the Work.
- B. Except for water heaters furnished with an integral cold water (anti-siphon) dip tube, water heaters shall be provided with an approved vacuum relief valve (complying with appropriate requirements of ANSI Z21.22), field installed in the cold water inlet piping.

2.02 DOMESTIC ELECTRIC WATER HEATER

- A. Heater shall be UL listed and have a glass-lined welded steel tank constructed in accordance with ASME for 150 psi working pressure. Tank shall have a three year limited warranty and be insulated with foam insulation and enclosed in baked enamel finish steel jacket. Heater shall be complete with immersion type incoloy heating element, immersion thermostat, high limit cutoff, fused transformer, magnetic contactors, hinged control panel door, cathodic protection anode(s) and brass/bronze drain valve. Heater shall employ an element diagnostics system utilizing an LED or LCD visual indication, corresponding to the number and location of each heating element. Heater shall be complete with AGA rated temperature and pressure relief (T&P) valve listed and installed in accordance with ANSI Z21.22. Unless indicated otherwise on Drawings, discharge of T&P valve shall be piped full size to outside of building. Unit size, capacity and voltage shall be as indicated on Drawings. Heater shall meet the 2021 IECC requirements. Heaters shall be Rheem Heavy Duty Electric or PowerPack Series, A.O. Smith DSE (Custom Xi) Series, or equal as listed by addendum.
- B. Point of use (utility) type heaters may have field installed drain valve at low side inlet in lieu of factory tank mounted valve. Also, for heaters which do not have a cold water (anti-siphon) dip tube, provide an approved vacuum relief valve (complying with appropriate requirements of ANSI Z21.22) at the water inlet to the heater; note, vacuum relief valve shall be positioned at an elevation above the top of the heater.

2.03 DOMESTIC-WATER THERMAL EXPANSION TANKS

- A. Domestic-Water Thermal Expansion Tanks shall be steel pressure-rated constructed with welded joints and factory installed FDA approved butyl-rubber diaphragm. Each tank shall have an operating working pressure of 150 PSIG (minimum), and shall include an air precharge, set to the minimum system-operating pressure at the installed location, (40 PSIG set pressure, unless noted otherwise on drawings). The tank shall be certified to NSF 61, and

interior water contacting surfaces of the tank shall comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets

B. Product Manufacturers and Model Series:

1. AMTROL Inc. THERM-X-TROL ST Series
2. Wilkins (Zurn) XT & WXT Series
3. Flexcon Industries WH & WHV Series
4. State Industries ETC Series
5. Watts PLT Series

2.04 DOMESTIC WATER CIRCULATORS

- A. Provide circulating pumps suitable for domestic hot water system where shown. Pumps shall be close-coupled, in-line type, bronze or stainless steel fitted, with mechanical seal and with capacities as scheduled.
- B. Provide return line temperature sensing controller (aquastat) and interlock with HVAC (DDC) building management system occupied/unoccupied scheduled time control (see Section 230060) to enable pump to operate via the aquastat during scheduled occupied time periods. The sensor of the aquastat is to be surface mounted directly to the hot water return piping, and is to be U.L. listed. In the occupied mode, the aquastat is to energize the pump whenever temperature sensed falls below 85°F and de-energize the pump whenever temperature sensed rises above 105°F.

2.05 SAFE PANS

- A. Provide safe pans under water heaters. Safe pans shall be constructed of 16 gauge type 304 stainless steel, with all joints lapped, riveted and soldered. Pans shall be a minimum of 4 inches deep and shall extend a minimum of 6 inches beyond all sides of the heater. Coordinate safe pan location with base supports.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install equipment as per manufacturer's requirements. Manufacturer's installation manuals shall be reviewed and equipment shall be installed in accordance with all requirements. Where discrepancies between these Specifications and the manufacturer's installation manual requirements arise, Contractor shall coordinate with Engineer for direction.

END OF SECTION

SECTION 220050 - PLUMBING FIXTURES AND ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE

- A. Plumbing fixtures shall be as specified below, or equal as listed by addendum.
- B. Rough-in locations shall be carefully spotted to result in a symmetrical pattern with sufficient spacing to accommodate full escutcheons.
- C. All fixtures shall have supplies with stops. Stops shall be chrome plated brass. Trim shall be polished, chrome plated brass, same manufacturer as fixture unless otherwise indicated. All pipe, fittings, etc., in connection with supply or drain trim shall be chrome plated. In cases where fixtures may have hot and cold water trim without hot water service, connect cold water to both trim inlets.
- D. Trap separately each fixture and piece of equipment requiring connection to drainage, unless otherwise shown on Drawings. Place traps as near to the fixture as possible. No fixture shall be double trapped. Unless indicated otherwise, drain "P" traps shall be polished, chrome plated cast brass with cleanout plug and 17 gauge tubular outlet to wall. For floor drains, hub drains or other similar devices with underfloor traps, drain "P" traps shall be same material as the branch piping system. For commercial food service equipment sinks, traps and waste piping to wall rough-in may be (rough finish) DWV copper piping (not plastic piping).
- E. All piping, plumbing fixtures and fittings, all solder and/or flux used in the installation or repair of any potable (domestic) water piping shall meet the "lead free" requirements of the Plumbing Code. Refer to Section 220020.

PART 2 - PRODUCTS

2.01 WATER CLOSET – WC-1

- A. General: Where the flush valve is shown to incorporate a trap primer, the vacuum breaker tube must be taller to meet the Plumbing Code; for example, utilize a Sloan model 113 rather than a 111.
- B. Refer to Architectural drawings for exact rough-in position.
- C. Fixture: Floor mounted, siphon jet type water closet with elongated bowl, 1-1/2" top spud and vitreous china construction. Furnish with bolt caps. Bowl height to be 15" to rim.
 - 1. Brands and Models:
 - a. American Standard 2234.001
 - b. Kohler K-96053
 - c. Sloan ST-2009-A
 - d. Zurn Z5655-BWL
- D. Flush Valve: Water saver (1.6 gpf) type with polished chrome finish, sweat solder adapter, vandal resistant stop cap, cast escutcheon and chloramine resistant components. Handle shall be ADA compliant and shall have a non-hold-open feature.

1. Brands and Models:

- a. Delta 81T201
- b. Sloan "Sloan" 111
- c. Zurn Aquaflush Plus Z6000PL-WS1

E. Seat: Solid polystyrene or polypropylene, extra heavy duty, white, open front seat with self-sustaining, check hinge.

1. Brands and Models:

- a. American Standard 5901.100SS
- b. Bemis 1655SSC
- c. Beneke 527SS
- d. Centoco 1500STSCSS
- e. Church 9500SSC
- f. Zurn Z5956SS-EL-STS

2.02 WATER CLOSET – WC-2

A. General: Water closet shall be designed and installed to meet the Americans With Disabilities Act (ADA) standard for physically impaired people, and the ANSI A117.1 standard. The top of the seat shall not exceed 19 inches above the finished floor. Manual flush valve handles (when used) shall be constructed to meet the ADA, shall be positioned on the wide side of the stall, and shall be installed not higher than 44 inches above the finished floor. Where the flush valve is shown to incorporate a trap primer, the vacuum breaker tube must be taller to meet the Plumbing Code, for example, utilize a Sloan model 113 rather than a 111. Also, contractor must verify clearances to the rear grab bar used in the installation, and if necessary, use a flush tube with an offset to avoid interference with the grab bar.

B. Refer to Architectural drawings for exact rough-in position.

C. Fixture: Floor mounted, siphon jet type water closet with elongated bowl, 1-1/2" top spud and vitreous china construction. Furnish with bolt caps. Bowl height to be 17" - 17-1/2" to rim.

1. Brands and Models:

- a. American Standard 3043.001
- b. Kohler K-96057
- c. Sloan ST-2029-A
- d. Zurn Z5665-BWL

D. Flush Valve: Water saver (1.6 gpf) type with polished chrome finish, sweat solder adapter, vandal resistant stop cap, cast escutcheon and chloramine resistant components. Diaphragm is to have clog-resistant linear (dual filtered) bypass feature. Handle shall be ADA compliant and shall have a non-hold-open feature.

1. Brands and Models:

- a. Sloan "Sloan" 111
- b. Zurn Aquaflush Plus Z6000PL-WS1

E. Seat: Solid polystyrene or polypropylene, extra heavy duty, white, open front seat with self-sustaining, check hinge.

1. Brands and Models:
 - a. American Standard 5901.100SS
 - b. Bemis 1655SSC
 - c. Beneke 527SS
 - d. Centoco 1500STSCCSS
 - e. Church 9500SSC
 - f. Zurn Z5956SS-EL-ST5

2.03 WATER CLOSET – WC-3

- A. General: Water closet shall be designed and installed to meet the Americans With Disabilities Act (ADA) standard for physically impaired people, and the ANSI A117.1 standard. The top of the seat shall not exceed 19 inches above the finished floor. Flush handles shall be designed to meet the ADA, and shall be positioned on the wide side of the stall.
- B. Refer to Architectural drawings for exact rough-in position.
- C. Fixture: Floor mounted, siphon jet type water closet with elongated bowl, tank with trim (1.6 gpf) and vitreous china construction. Furnish with 3/8" angle supply-stop and bolt caps. Bowl height to be 17"- 17-1/2" to rim.

1. Brands and Models:
 - a. American Standard 211AA.004
 - b. Kohler K-3589
 - c. Sloan WETS 9023-1.6
 - d. Zurn Z5551

- D. Seat: Solid polystyrene or polypropylene, extra heavy duty, white, open front seat with self-sustaining, check hinge.

1. Brands and Models:
 - a. Bemis 1655SSC
 - b. Beneke 527SS
 - c. Centoco 1500STSCCSS
 - d. Church 9500SSC
 - e. Zurn Z5956SS-EL-ST5

2.04 URINAL – UR-1

- A. General: Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Wall hung, siphon jet type urinal with extended shields, integral flush spreader and trap, 3/4" top spud and vitreous china construction.

1. Brands and Models:
 - a. American Standard 6561.017

- C. Supporting Carrier: Cast iron floor mounted chair carrier with hanger and bearing plates.

Carrier feet shall be securely bolted to floor.

1. Brands and Models:

- a. J.R. Smith 0637
- b. Josam 17560-UR
- c. Mifab MC-32
- d. Wade 400-AM11
- e. Watts CA-321
- f. Zurn Z1222

- D. Flush Valve: Water saver (1.0 gpf) type with polished chrome finish, sweat solder adapter, vandal resistant stop cap, cast escutcheon and chloramine resistant components. Handle shall be ADA compliant and shall have a non-hold-open feature.

1. Brands and Models:

- a. Delta 81T231-38
- b. Sloan "Sloan" 186-1.0
- c. Zurn Aquaflush Plus Z6003PL-WS1

2.05 URINAL – UR-2

- A. Same as UR-1 except that urinal shall be designed and installed to meet the Americans With Disabilities Act (ADA) standard for physically impaired people, and the ANSI A117.1 standard. The rim mounting height shall be 17 inches above the finished floor. Manual flush valve handles (when used) shall be constructed to meet the ADA, and shall be installed not higher than 44 inches above the finished floor.
- B. Refer to Architectural drawings for exact rough-in position.

2.06 LAVATORY – L-1

- A. General: Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Undermount, nominal 19" x 16", lavatory with front overflow and vitreous china construction.
1. Brands and Models:
- a. Kohler Equal K-5400
- C. Faucet Set: 8" concealed deck mount mixing faucet with forged brass body, swivel/rigid gooseneck with laminar flow aerator, compression cartridges with spring checks, 1.5 GPM flow disc, 4" wrist action handles, chrome plated escutcheons and 1/2" NPT male inlets with coupling nuts. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372. Meets ADA ANSI/ICC A117.1 requirements. Provide aerator by Neoperl, clinic snap honeycomb style with all required adapters. Provide a total of eight inserts, 2 each in blue, green, red, and yellow colors.
1. Brands and Models:
- a. T&S Brass B-2866-05FC15.

- D. Drain: Furnish a cast brass, grid strainer type drain with a polished chrome plated finish.
 - 1. Brands and Models: Drains may be as furnished by manufacturer of faucet or may be one of the following:
 - a. Dearborn 760-1
 - b. McGuire 155A

- E. Lavatory shall be designed and installed to meet the Americans With Disabilities Act (ADA) standard for physically impaired people, and ANSI 117.1 Standard. Unless indicated otherwise on the Contract Drawings, lavatory is to be installed with a rim height 34 inches (maximum) above finished floor. Lavatory shall have a minimum clearance of 29 inches measured from the floor to the bottom of the lavatory apron. Exposed drain and water piping under lavatory shall not interfere with required knee clearance, 8.5 inches measured horizontally from front edge toward rear of lavatory. Provide PVC two-piece, snap-on, insulated covers over trap and both hot and cold water supplies. For lavatories with drain type trap primers, include a matching cover for trap primer line. Covers shall meet 25/450 Flame/Smoke Rating per ASTM-E84.
 - 1. Brands and Models:
 - a. IPS Corporation Truebro "Lav Guard 2" series
 - b. Plumberex Pro-Extreme series
 - c. Zurn Z8946-1-NT

2.07 LAVATORY – L-2

- A. General: Refer to Architectural drawings for exact rough-in position.

- B. Fixture: Wall-mounted nominal 19" x 16" lavatory with rear overflow and vitreous china construction.
 - 1. Brands and Models:
 - a. American Standard 0958008EC with 8" center faucet holes
 - b. Equal by Kohler

- C. Faucet Set: 8" concealed deck mount mixing faucet with forged brass body, swivel/rigid gooseneck with laminar flow aerator, compression cartridges with spring checks, 1.5 GPM flow disc, 4" wrist action handles, chrome plated escutcheons and 1/2" NPT male inlets with coupling nuts. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372. Meets ADA ANSI/ICC A117.1 requirements. Provide aerator by Neoperl, clinic snap honeycomb style with all required adapters. Provide a total of eight inserts, 2 each in blue, green, red, and yellow colors.
 - 2. Brands and Models:
 - a. T&S Brass B-2866-05FC15.

- D. Drain: Furnish a heavy cast brass, grid strainer type drain with a polished chrome plated finish.
 - 1. Brands and models: Drains may be as furnished by manufacturer of faucet or may be one of the following:

- a. Dearborn 760-1
 - b. McGuire 155A

- E. Lavatory shall be designed and installed to meet the Americans With Disabilities Act (ADA) standard for physically impaired people, and ANSI 117.1 Standard. Unless indicated otherwise on the Contract Drawings, lavatory is to be installed with a rim height 34 inches (maximum) above finished floor. Lavatory shall have a minimum clearance of 29 inches measured from the floor to the bottom of the lavatory apron. Exposed drain and water piping under lavatory shall not interfere with required knee clearance, 8.5 inches measured horizontally from front edge toward rear of lavatory. Provide PVC two-piece, snap-on, insulated covers over trap and both hot and cold water supplies. For lavatories with drain type trap primers, include a matching cover for trap primer line. Covers shall meet 25/450 Flame/Smoke Rating per ASTM-E84.
 - 1. Brands and Models:
 - a. IPS Corporation Truebro "Lav Guard 2" series
 - b. Plumberex Pro-Extreme series
 - c. Zurn Z8946-1-NT

2.08 POINT-OF-USE THERMOSTATIC MIXING VALVE

- A. General: Provide point-of-use type thermostatic mixing valves where called for herein, or as shown on drawings. Devices must be approved by the Plumbing Code and comply with ASSE 1070. Each mixing valve is to include integral check valves on hot and cold water inlets.

- B. For each single (individual) lavatory, provide point-of-use thermostatic mixing valve, Leonard Model 170-BP, or Bradley S59-4000BY Series or equal as listed by addendum, 0.35 GPM minimum flow rate and peak flow rate of 1.7 GPM at 5 PSIG (maximum) pressure drop. Position mixing valve directly beneath countertop (so as not to interfere with ADA clearances). Extend/connect outlet of mixing valve to hot water inlet of lavatory faucet.

- C. For each side-by-side pair of lavatories, (in lieu of individual thermostatic mixing valve for each faucet) point-of-use thermostatic mixing valve may be common mixing valve to temper the hot water inlet for both of the lavatory faucets. Common thermostatic mixing valve serving two faucets shall be Leonard Mode 270, Bradley S59-4016 or equal as listed by addendum, 0.5 GPM minimum flow rate and peak flow rate of 3.5 GPM at 5 PSIG (maximum) pressure drop. Position mixing valve directly beneath countertop (so as not to interfere with ADA clearances). Extend/connect 1/2" hot and cold water lines to appropriate inlet connections of mixing valve and extend/connect 1/2" tempered water line from outlet of mixing valve to hot water inlet of the lavatory faucet pairs; install horizontal piping segments tight to underside of countertop, so as not to interfere with ADA clearances.

2.9 SINK – SK-1

- A. General: Sinks shall be drilled for style faucet specified. Refer to Architectural drawings for exact rough-in position.

- B. Fixture: Countertop mounted 19" x 18" single bowl, self-rimming sink, 18 gauge stainless steel construction, with faucet ledge and full sound deadening on bowls.

1. Brands and Models:
 - a. Elkay LR-1918
 - b. Equal by Just

- C. Faucet Set: 8" concealed deck mount mixing faucet with forged brass body, swivel/rigid gooseneck with plain (open) end outlet, compression cartridges with spring checks, 1.5 GPM flow disc, 4" wrist action handles, chrome plated escutcheons and 1/2" NPT male inlets with coupling nuts. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372. Meets ADA ANSI/ICC A117.1 requirements. Provide aerator by Neoperl, clinic snap honeycomb style with all required adapters. Provide a total of eight inserts, 2 each in blue, green, red, and yellow colors.
 1. Brands and Models:
 - a. T&S Brass B-2866-05FC15.

- D. Drain: Furnish a sink drain assembly consisting of a type 304 stainless steel drain body and basket strainer, and a chrome plated brass tailpiece.
 1. Brands and Models:
 - a. Elkay LK36
 - b. Just J-15-CC

2.10 SINK – SK-2

- A. General: Sinks shall be drilled for style faucet specified and with any additional holes required for accessories, such as a water spray. Refer to Architectural drawings for exact rough-in position.

- B. Fixture: Countertop mounted 17" x 20" single bowl, self-rimming sink, 18 gauge stainless steel construction, with faucet ledge and full sound deadening on bowl.
 1. Brands and Models:
 - a. Elkay LR-1720
 - b. Just SL-2017-A-GR

- C. Faucet Set: 8" concealed deck mount mixing faucet with forged brass body, swivel/rigid gooseneck with plain (open) end outlet, compression cartridges with spring checks, 1.5 GPM flow disc, 4" wrist action handles, chrome plated escutcheons and 1/2" NPT male inlets with coupling nuts. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372. Meets ADA ANSI/ICC A117.1 requirements. Provide aerator by Neoperl, clinic snap honeycomb style with all required adapters. Provide a total of eight inserts, 2 each in blue, green, red, and yellow colors.
 1. Brands and Models:
 - a. T&S Brass B-2866-05FC15.

- D. Drain: Furnish with a sink drain assembly consisting of a type 304 stainless steel drain body and basket strainer, and a chrome plated brass tailpiece.

1. Brands and Models:

- a. Elkay LK35
- b. Just J-35

2.11 SINK – SK-3

A. General: Refer to Architectural drawings for exact rough-in position.

B. Fixture: Undermount nominal 30" x 18" constructed of 18 gauge 304 stainless steel construction.

1. Brands and Models:

- a. Elkay ELUHAD281655PD
- b. Just Equal

C. Faucet Set: 8" concealed deck mount mixing faucet with forged brass body, swivel/rigid gooseneck with laminar flow aerator, compression cartridges with spring checks, 1.5 GPM flow disc, 4" wrist action handles, chrome plated escutcheons and 1/2" NPT male inlets with coupling nuts. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372. Meets ADA ANSI/ICC A117.1 requirements. Provide aerator by Neoperl, clinic snap honeycomb style with all required adapters. Provide a total of eight inserts, 2 each in blue, green, red, and yellow colors.

1. Brands and Models:

- a. T&S Brass B-2866-05FC15.

D. Drain: Furnish a heavy cast brass, grid strainer type drain with a polished chrome plated finish.

1. Brands and models: Drains may be as furnished by manufacturer of faucet or may be one of the following:

- a. Dearborn 760-1
- b. McGuire 155A

E. Lavatory shall be designed and installed to meet the Americans With Disabilities Act (ADA) standard for physically impaired people, and ANSI 117.1 Standard. Unless indicated otherwise on the Contract Drawings, lavatory is to be installed with a rim height 34 inches (maximum) above finished floor. Lavatory shall have a minimum clearance of 29 inches measured from the floor to the bottom of the lavatory apron. Exposed drain and water piping under lavatory shall not interfere with required knee clearance, 8.5 inches measured horizontally from front edge toward rear of lavatory. Provide PVC two-piece, snap-on, insulated covers over trap and both hot and cold water supplies. For lavatories with drain type trap primers, include a matching cover for trap primer line. Covers shall meet 25/450 Flame/Smoke Rating per ASTM-E84.

1. Brands and Models:

- a. IPS Corporation Truebro "Lav Guard 2" series
- b. Plumberex Pro-Extreme series
- c. Zurn Z8946-1-NT

2.12 SINK – SK-4

- A. General: Sinks shall be drilled for style faucet specified. Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Countertop mounted 15" x 15" single bowl, self-rimming sink, 18 gauge stainless steel construction, with faucet ledge and full sound deadening on bowls.
 - 1. Brands and Models:
 - a. Elkay BLR-15
 - b. Just SBL-1515-A-GR
- C. Faucet Set: 8" concealed deck mount mixing faucet with forged brass body, swivel/rigid gooseneck with plain (open) end outlet, compression cartridges with spring checks, 1.5 GPM flow disc, 4" wrist action handles, chrome plated escutcheons and 1/2" NPT male inlets with coupling nuts. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372. Meets ADA ANSI/ICC A117.1 requirements. Provide aerator by Neoperl, clinic snap honeycomb style with all required adapters. Provide a total of eight inserts, 2 each in blue, green, red, and yellow colors.
 - 1. Brands and Models:
 - a. T&S Brass B-2866-05FC15.
- D. Drain: Furnish a sink drain assembly consisting of a type 304 stainless steel drain body and basket strainer, and a chrome plated brass tailpiece.
 - 1. Brands and Models:
 - a. Elkay LK36
 - b. Just J-15-CC

2.13 ELECTRIC WATER COOLERS - GENERAL

- A. Water coolers shall be the type as indicated below, or an equal as listed by addendum. The cooler shall have a stainless steel top and backsplash. Capacities listed below are at ARI Standard 1010-73 conditions unless indicated otherwise. Coolers shall meet the Standards of the Safe Drinking Water Act and the Lead Contamination Act. Miscellaneous appurtenances required for connection, such as water stops and P-traps, shall be as specified elsewhere in this specification. Contractor shall provide suitable wall reinforcement for all wall mounted supports.

2.14 EWC-1

- A. Fixture: Wall hung, barrier free, bottle filling, split-level type water cooler, with front and side push actuators. Provide with apron adapter (cane apron).
- B. Capacity: 8 gph.
- C. Finish: Cooler front and side enclosure shall be stainless steel with a satin polished finish.
- D. Brands and Models:
 - 1. Elkay LZSTL8WSSP
 - 2. Halsey Taylor HTHB-HAC 8BL SS-WF

- E. Unless indicated otherwise on drawings, water coolers shall be installed in compliance with the Americans With Disabilities Act (ADA) Standard for physically impaired people, and to the ANSI 117.1 Standard. Unless indicated otherwise on drawings, install the cooler with the bubbler (spout) no higher than 36" above the finished floor, and with a clear knee space of 27" measured between the bottom of the cooler basin and the finished floor.

2.15 MOP SINK – MS

- A. General: Contractor to provide suitable wall reinforcement for all wall supports. Refer to Architectural drawings for exact rough-in position.
- B. Fixture: One piece, precast terrazzo mop basin with 2" thick x 12" high sides and integrally cast 3" drain with strainer. On installations where walls are to receive tile, provide with cast-in tiling flanges on abutted walls. On installations with all other wall types, furnish 12" high stainless steel guards for all walls, width to match full length/width of sink.
- C. Furnish with faucet and accessories as indicated below.
- D. Fixture: Five sided, 36" x 36", full height sides, Neo-Corner with 6" drop front and stainless steel cap.
 - 1. Brands and Models:
 - a. Acorn TNC-36
 - b. Fiat TSBC-1612
 - c. Stern-Williams SBC-1750
- E. Faucet: Wall mounted mixing faucet with integral stops and checks, 3/4" male hose threaded spout with pail hook, and wall brace. Faucet shall include factory modification to **provide elevated continuous pressure vacuum breaker assembly**, see detail on drawings.
 - 1. Brands and Models:
 - a. T&S Brass B-0695-ST MOD (with spring check feature)
 - b. Zurn 873E2-CS-IS-420XL (modified for vacuum breaker)

2.16 SERVICE SINK – SS

- A. General: Contractor to provide suitable wall reinforcement for all wall supports. Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Cast iron service sink with acid resisting enameled finish, 24"x20" size, with stainless steel rim guard, wall hanger and drilled back. Furnish with faucet and accessories as indicated below.
- C. Brands and Models:
 - 1. American Standard 7695.008

2. Commercial Enameling 866
 3. Kohler K-6716
 4. Zurn Z5898
- D. Trap Standard: Cast iron "P" trap standard to wall, with 3" outlet, adjustable floor support, sink strainer and cleanout plug.
1. Brands and Models:
 - a. American Standard 7798.030
 - b. J.R. Smith Fig. 9120
 - c. Kohler K-6673
 - d. Wade 803
 - e. Zurn Z5900-IP3
- E. Faucet: Back splash mounted mixing faucet with vacuum breaker, integral stops, 3/4" male hose threaded spout with pail hook, and rough chrome finish.
1. Brands and Models:
 - a. American Standard 8350.243
 - b. Kohler K-8906-RP
 - c. T&S Brass B-0674-BSTR
 - d. Zurn Z843-L1-RC

2.17 ICE MAKER SERVICE BOX - IMSB

- A. Fixture: Flush mounted water service box, 20 ga. steel, water-tight construction, with galvanized or white powder coat finish, and a brass angle valve with compression outlet. Valve shall be low-lead type.
- B. Brands and Models:
1. Guy Gray Model BIM-875AB
 2. Oatey 39141

2.18 WASHER SERVICE BOX - WSB

- A. Fixture: Flush mounted washer service box, 20 ga. steel, water-tight construction, with galvanized or white powder coat finish, 2" bottom drain outlet and two brass valves with male hose threads on outlets.
- B. Brands and Models:
1. Guy Gray Model T-200
 2. Oatey 38993

2.19 HOSE BIBBS - HB

- A. Fixture: Hose bibbs shall be a cast brass, angle pattern faucet with 3/4" male hose threaded outlet, complete with an anti-siphon vacuum breaker, (lockshield and loose key)

(and metal wheel handle). Vacuum breaker shall comply with A.S.S.E. Standard 1011. All components to have a rough chrome or nickel plated finish.

B. Brands and Models:

1. MIFAB MHY-90 Series
2. Prier C-255NP (lockshield) C-155NP (wheel handle)
3. Woodford 24P
4. Zurn Z1341-P34-RP

2.20 WALL HYDRANTS - WH

A. Fixture: Hydrants shall be a cast brass, close-coupled faucet with $\frac{3}{4}$ " male hose threaded outlet, complete with an anti-siphon vacuum breaker, and a loose key operator, all mounted in a cast brass or bronze box with cast cover. Vacuum breaker shall comply with A.S.S.E. Standard 1011. All components to have a rough chrome or satin nickel bronze finish.

B. Brands and Models:

1. J.R. Smith 5509QT-SAP-NB
2. Josam 71020-54
3. MIFAB MHY-35
4. Wade 8600MT-175
5. Woodford B74
6. Zurn Z1330-NB

2.21 DRAINS – GENERAL

A. Body castings shall be of a high grade, even grain cast iron, free from defects which might affect their serviceability, and with a $\frac{1}{4}$ " minimum wall thickness. Drain body shall have a bottom caulk outlet, except on upper floors, drain may have a no-hub outlet unless indicated otherwise. All floor drains shall be installed with a deep seal P-trap. All grates, strainers and trim shall be nickel bronze unless indicated otherwise below. Floor drains installed in new or existing slabs shall be positioned so the top of the drain is $\frac{3}{8}$ " to $\frac{1}{2}$ " below the finished slab, and the slab shall be evenly sloped to the drain.

2.22 FLOOR DRAINS – FD-1

A. Fixture: General purpose floor drain with an adjustable 6" diameter, heavy-duty, nickel bronze strainer, and a non-puncturing membrane clamping device on body. Provide a $\frac{1}{2}$ " trap primer connection at inlet to the drain P-trap.

B. Brands and Models:

1. J.R. Smith 2010-C
2. Josam 30000-E
3. MIFAB F1100-C-X
4. Wade 1100-AX
5. Watts FD-100-B
6. Zurn ZN415-HD

2.23 FLOOR DRAINS – FD-2

- A. Fixture: General purpose floor drain with an adjustable 6" diameter, heavy-duty, nickel bronze strainer, and a non-puncturing membrane clamping device on body. Provide a 1/2" trap primer connection at inlet to the drain P-trap.
- B. Brands and Models:
 - 1. J.R. Smith 2010-C
 - 2. Josam 30000-E
 - 3. MIFAB F1100-C-X
 - 4. Wade 1100-AX
 - 5. Watts FD-100-B
 - 6. Zurn ZN415-HD

2.24 FLOOR SINK – FS-1

- A. Fixture: 12" x 12" x 8" deep 16 gauge, All Type 304 (CF8) stainless steel sanitary floor area and indirect waste drain complete with cast stainless steel secured rim and half grate with allen key vandal proof stainless steel screws, stainless steel anchor flange with weepholes and anti-splash dome strainer.
- B. Where noted on the drawings, provide a 1/2" trap primer connection at inlet to the drain P-trap to receive piping connection from Trap Primer TP-2. Otherwise provide Elastomeric Trap Primer (ETP), as specified elsewhere in this section, at waste piping outlet from each Floor Drain FS-2.
- C. Brands and Models:
 - 1. Watts FS-790-150
 - 2. MIFAB FS1933-FL-150
 - 3. Zurn Z1751-2

2.25 ELASTOMERIC TRAP PROTECTOR – ETP

- A. General: Provide trap protectors where called for herein, or as shown on drawings. Devices must be approved by the Plumbing Code.
- B. Fixture: Trap protectors shall be a self-sealing, flexible elastomeric device. The elastomeric sealing material shall be molded into the shape of a "duck's bill", open at the top inlet, and with a closure seal at the bottom, and shall prevent the passage of sewer gas emissions when closed. The self-sealing device shall allow full water flow through the floor drain, shall be resistant to common chemicals and cleaners, and shall allow passage of drain cleaning equipment cables and hoses. The device shall be accessible for inspection and replacement via removal of the floor drain's strainer top.
- C. Brands and Models:
 - 1. J.R. Smith 2692 (for compatible drains only)
 - 2. ProVent Trap Guard
 - 3. SureSeal SS series

2.26 TRAP PRIMER – TP-1

- A. General: Trap primer assembly shall be installed under lavatory in lieu of P-trap assembly previously specified in this section. Provide one trap primer assembly for each floor drain. Extend a 1/2" copper water line from the trap primer supply connection to the floor drain, keeping line sloped evenly down toward the drain it serves to prevent trapping water in the line. All water piping beyond connection point to trap primer supply shall be concealed within wall and floor.
- B. Fixture: Trap primer shall be an assembly consisting of a lavatory tailpiece with side outlet, cast brass P-trap with cleanout, 17 gauge tubular outlet to wall, slip joint nuts, primer tube to wall with fittings, and escutcheons. All components shall have a polished chrome plated finish.
- C. Brands and Models:
 - 1. J.R. Smith 2698 "Prime-Eze"
 - 2. MIFAB MI-750
 - 3. Zurn Z1021-WL

2.27 TRAP PRIMER – TP-2

- A. General: Trap primer valve may be located anywhere in an active cold water line near and above the floor drain. Up to four floor drains located in close proximity to the primer may be served by a single trap primer utilizing a pre-manufactured distribution unit. Trap primers shall be listed by the Uniform Plumbing Code (UPC), and shall meet ASSE Standard 1018. In addition, backflow prevention devices shall be in conformance with all applicable sections of the Plumbing Code. Extend a 1/2" copper water line from the trap primer (or manifold where applicable) to the floor drain, keeping line sloped evenly down toward the drain it serves to prevent trapping water in the line.
- B. Fixture: Trap primer shall be a fully automatic type with no adjustment required, and shall be activated by a drop in building water pressure. Primer shall have 1/2" inlet and outlet connections and shall be of all brass construction. Manifolds, if used, shall be by the same manufacturer as the primer device.
- C. Brands and Models:
 - 1. Josam 88300 Series
 - 2. MIFAB MR-500
 - 3. Precision Plumbing Products (PPP) Prime-Rite PR-500

2.28 CLEANOUTS – GENERAL

- A. Provide cleanouts where shown on the drawings and wherever required for easy service of the installation. Cleanouts shall be the same size as the pipe served, except cleanout plugs larger than 4" will not be required.
- B. Body castings shall be of a high grade, even grain cast iron, free from defects which might affect their serviceability, and with a 1/4" minimum wall thickness. Cleanout body shall have a bottom caulk outlet, except on upper floors, cleanout may have a no-hub outlet unless indicated otherwise. All tops and trim shall be nickel bronze unless indicated otherwise below.

2.29 CLEANOUTS – CO

- A. Fixture: General purpose floor cleanout with an adjustable, standard-duty, scoriated nickel

bronze top. For installation in floors with membranes, furnish with a non-puncturing membrane clamping device on body.

- B. Tops shall be suitable for flooring surface in which they are installed. Where a flooring material (such as Terrazzo) covers the cleanout, the top shall be of a type which is readily incorporated into the covering system without ridges or recesses. Tops must be flush with the finished floor, except where carpet is used, a top incorporating a small round marker (carpet marker) shall be used.
- C. Use square tops in surfaces such as tile, brick, slate and other square or rectangular patterned surfaces, aligning the top with the floor pattern. Cleanouts in unfinished floors shall have heavy-duty, scoriated nickel bronze tops. Outdoor cleanouts shall be as detailed on the drawings.
- D. Brands and Models:
 - 1. J.R. Smith 4000
 - 2. Josam 55000-2
 - 3. MIFAB C1 220-1
 - 4. Wade 6000-STD
 - 5. Watts CO-200-R
 - 6. Zurn ZN1 400

2.30 WALL CLEANOUTS – WCO

- A. Fixture: General purpose wall cleanout with a cast iron ferrule, plastic or bronze threaded plug, polished stainless steel or chrome plated brass round cover, and stainless steel cover attachment screw. Cover shall be no larger than 6" in diameter.
- B. Brands and Models:
 - 1. J.R. Smith 4422C
 - 2. Josam 58600-CO
 - 3. MIFAB C1 450-RD
 - 4. Wade 8550-E with 8480R
 - 5. Watts CO-380-RD
 - 6. Zurn ZN1 441

2.31 ROOF DRAIN – RD

- A. General: Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Roof drains shall be large sump variety with flange, complete with non-puncturing, bolted clamping collar with integral gravel stop, adjustable extension sleeve/collar, and a removable cast iron dome strainer. All roof drains, except those used in poured-in-place deck installations, shall have a separate under-deck clamp, and a sump receiver bearing pan.
- C. Brands and Models:
 - 1. J.R. Smith 1015-R-C-CID
 - 2. Josam 21500-AE-3-22
 - 3. MIFAB R1 200-EU-E-B-U-M
 - 4. Wade 3000-AE-42-52-53
 - 5. Watts RD-100-F-D-K

6. Zurn ZC100-EA-C-R

2.32 OVERFLOW DRAIN – RD

- A. General: Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Overflow roof drains shall be large sump variety with flange, complete with non-puncturing, bolted clamping collar with integral gravel stop, adjustable extension sleeve/collar, PVC standpipe, and a removable cast iron dome strainer. All overflow roof drains, except those used in poured-in-place deck installations, shall have a separate under-deck clamp, and a sump receiver bearing pan.
- C. Brands and Models:
 1. J.R. Smith 1070-E-R-C-CID
 2. Josam 21500-16-AE-3-22
 3. MIFAB R1200-W-E-B-U-M
 4. Wade 3000-SD-AE-42-52-53
 5. Watts RD-100-W-F-D-K
 6. Zurn ZC100-W4-EA-C-R

2.33 DOWNSPOUT NOZZLE – DS

- A. General: Refer to Architectural drawings for exact rough-in position.
- B. Fixture: Cast bronze nozzle with threaded inlet and flange/wall anchor assembly.
- C. Brands and Models:
 1. J.R. Smith 1770
 2. Josam 25010
 3. MIFAB R1940
 4. Wade 3940
 5. Watts RD-940
 6. Zurn ZANB199

2.34 WATER HAMMER ARRESTORS

- A. General: Furnish in conjunction with fixtures or fixture groups throughout the building, water hammer arrestors (shock absorbers). Water hammer arrestors shall utilize a nested stainless steel bellows permanently sealed within a stainless steel shell, and shall be pre-charged with nitrogen or helium gas. Arrestors shall meet ASSE Standard 1010 and shall be of low-lead construction. Sizing and placement of arrestors shall be in accordance with PDI Standard WH-201. Long isolated runs to single fixtures, such as an EWC or lavatory, without a quick-acting valve, may use field fabricated air chambers.
- B. Brands and Models (Bellows Style):
 1. J.R. Smith 5000 series
 2. Josam 75000 series
 3. MIFAB WHB series
 4. Wade "Shokstop" SS series
 5. Watts SS series
 6. Zurn Z1700 series

- C. Alternative Style: Contractor may alternatively use piston style water hammer arrestors. These arrestors shall utilize a floating piston sealed with dual EDPM O-rings inside a permanently sealed copper tube, and shall be internally lubricated with FDA approved silicone compound. Units shall be pre-charged with air, and shall carry the same approvals as above.
- D. Brands and Models (Piston Style):
 - 1. Josam 75000-S series
 - 2. MIFAB MWH series
 - 3. Precision Plumbing Products (PPP) SC Commercial series
 - 4. Wade "Shokstop" P series
 - 5. Watts SG series
 - 6. Zurn WH2950XL series
 - 7. Zurn/Wilkens 1250XL series

PART 3 - EXECUTION

3.01 GENERAL

- A. Immediately after installation of plumbing fixtures, cover each fixture with a fixture protector. Take every possible precaution for the protection of fixtures and connections and replace any fixture or other work damaged with no additional cost to the Owner.
- B. Provide suitable (silicone base) caulking material between fixture and wall/floor/countertop (as applicable) for each fixture type such as water closets, urinals, lavatories, sinks, showers, etc.; caulking material shall form a neat bead around the perimeter of fixture to form a watertight joint.

END OF SECTION

SECTION 230000 - HVAC GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

- A. These Specifications are intended to provide complete and in proper operation all Heating, Ventilating and Air Conditioning (HVAC) systems, all as specified herein or shown on the accompanying Drawings, or reasonably implied in either, and including roughing-in services and connections for equipment furnished under other contracts or by the Owner, unless shown otherwise. The term "the Contractor" as used in this section of these Specifications shall denote the HVAC Sub-Contractor.
- B. All electrical work, associated with HVAC systems, shall be done under the Electrical Section of these Specifications, except where indicated. See DIVISION 26 - ELECTRICAL. Furnish wiring diagrams and any other information required for all wiring in connection with HVAC Equipment and Controls.
- C. Painting, except for special coats as herein specified, is included in other sections of the Specifications, see DIVISION 09 - FINISHES. The Contractor shall coordinate and inform DIVISION 09 Tradesman for the painting of all non-insulated or coated piping, support steel and fittings including valves. This piping shall include steel piping, supports, valves, flanges and hangers. It does not include cast iron or plastic or copper piping. It shall include touch up on welding for equipment having factory finishes. It is intended that all piping not insulated or manufacturer pre-coated (galvanized, for example) and all other metals furnished and installed under this subcontract that are subject to rusting or discoloration be painted. Before finished coat of painting is applied, items outdoors and indoors shall have a base coat of cold galvanizing compound or industrial grade rust inhibiting primer (compatible with final coating).
- D. For color coding of HVAC items, coordinate with Painting Contractor and provide the color list as required, see Section 230010.
- E. The Contractor shall verify all utility tie-in points for exact location, elevation and size and shall verify all routings and determine any interference with existing obstructions or obstructions that might result from other work in this project.

1.02 GENERAL CONDITIONS

- A. The Instructions to Bidders, General Conditions and Special and Supplementary Conditions, all contained in DIVISION 01 - GENERAL REQUIREMENTS, shall be part of this section of the Specifications the same as if attached hereto. The Contractor shall read and be thoroughly familiar with all provisions of the above referenced section.
- B. It is understood that these Specifications and the accompanying Drawings, contemplate complete apparatus, fully erected and in successful operating condition. All work shall be performed in the best and most substantial manner.

1.03 MANUFACTURERS, TRADE NAMES, AND SUBSTITUTIONS

- A. Where the Drawings and Specifications mention the products of specific manufacturers, it is intended that the Contractor shall furnish the items as specified, or a substitute listed by addendum to the Specifications. Request for substitution shall be made in writing at least

seven working days before bids are taken unless required otherwise in the Architectural Specifications. Requests shall include all materials necessary and exact model numbers proposed to fully evaluate the substitution or they will not be considered for review. Request shall also show where the substitution is compliant with the Specifications and any deviations from the Specifications or they will be rejected. The burden of equivalency shall be on the Contractor.

- B. The Contractor shall bid all materials as specified in these Specifications, Drawings, and Addenda. Should the Contractor submit a bid that is not inclusive of all project document requirements, the Contractor shall be responsible for all cost associated to align his materials to comply with project documents.

1.04 ORDINANCES, RULES AND REGULATIONS

- A. All material and construction shall conform to the requirements of all building codes, sanitary codes and laws and ordinances in force in the locality in which the work shall be done. All materials and construction shall also conform to the rules and regulations of the National Fire Protection Association, Underwriter's Laboratories and National Electrical Manufacturers' Association.

1.05 PERMITS, FEES AND INSPECTIONS

- A. Contractor shall obtain all permits and inspections required in connection with this work and shall pay any fees or other costs involved. Inspections shall include (but not be limited to) boilers, etc., as required by State and/or Local Regulating Authorities for the system(s) to be installed. Unless indicated otherwise, Contractor shall coordinate with the various companies and pay fees required for utility service connections and meters, including gas and domestic water.

1.06 GUARANTEE

- A. The Contractor shall guarantee all materials and workmanship under this contract for a period of one year from date of final acceptance, as defined by the Architect, of his work and shall repair and replace any such defective materials and workmanship without cost to the Owner.
- B. The Contractor shall guarantee all equipment be of the quality and capacity specified.
- C. The Owner shall be responsible for routine maintenance such as, oiling, greasing and changing of filters during the warranty period under the Contractor's instructions. Contractor shall furnish the Owner a list of routine maintenance items and shall inspect the project monthly and report to the Architect, in writing, if Owner maintenance is not being performed.

1.07 WARRANTIES

- A. Refer to DIVISION 01 - GENERAL REQUIREMENTS for procedures and submittal requirements for warranties. Refer to individual equipment specifications for specific warranty requirements. Compile and assemble the warranties specified in the "HVAC WORK" into a separated set of vinyl covered and suitable three ring type permanent binders, tabulated and indexed for easy reference. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond, duration of warranty or bond, names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.08 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide three copies of typewritten system operating instructions and three copies of operating and maintenance brochures for each piece of equipment including manufacturer's descriptive bulletins with wiring diagrams, parts lists and specific lubricating and maintenance instructions. Brochures shall be bound in suitable vinyl covered, three ring type permanent binders, tabulated and suitably indexed.
- B. In addition, provide a digital copy of all operating instructions and operating and maintenance brochures (in PDF format) all as specified above.

1.09 SYSTEM OPERATION AND EARLY START-UP

- A. System Operation: Generally, HVAC air handling systems shall not be operated for space ventilation/heating/cooling/dehumidification purposes until which time at least the following project scope has been completed for each system to be operated:
 - 1. All air distribution (ductwork) and piping serving the air systems have been installed and insulated.
 - 2. Temporary seals for ductwork openings have been removed and specified air filters are properly installed within the air handling unit(s).
 - 3. Start-up services have been completed for the HVAC equipment to be operated (including VFD's, where applicable).
 - 4. Installation of temperature control system (along with dependant fire-alarm components) has been completed and proper operation has been verified.
 - 5. Initial balancing and operating tests have been performed to verify stable operating conditions for system components.
 - 6. For the spaces served by the air handling systems, the interior finishes (including dry wall sanding and/or other dust generating construction activities) have been completed and the spaces are cleaned and maintained clean in preparation for Owner acceptance of the building.
- B. Early Start-up: For construction situations where space ventilation/heating/cooling/dehumidification is necessary prior to the completion of interior finishes, temporary heating/cooling systems (other than the building's permanent HVAC systems) shall be provided for this purpose. However, if the building's permanent HVAC system must, in the opinion of the Contractor, be utilized for this purpose, then the Contractor is to present a written plan of action for operating and maintaining the HVAC system components for this "early start-up" situation. The early start-up plan of action must include a description of the construction dust control (reduction) techniques to be utilized while the air handling systems are operational plus a schedule for routine maintenance of the operating HVAC components, including air filter change-out; this early start-up plan of action must be approved by the architect prior to operating any component of the building's permanent HVAC system. Early start-up of equipment shall not affect the required one year guarantee time period, beginning from date of final acceptance (see "GUARANTEE", in this Specification Section). For early start-up of permanent HVAC systems, appropriate air filtration shall be provided at both the air unit's inlet filter rack and at each return air (RA) duct inlet. The early start-up air filters shall have a minimum MERV rating of 12 for the air unit's inlet filter rack and MERV 8 for each RA duct inlet. Upon Owner acceptance of the project, the Contractor is to remove the early start-up filters and install the air handling unit's specified filters in each unit plus turn-over to the Owner the specified spare set of filters. Permanent air handling systems enduring early start-up will be subject to cleanliness testing, at the discretion of the architect (NADCA vacuum test not to exceed 0.75 mg/100 sq.cm., per NADCA assessment, cleaning

and restoration (ACR) of HVAC systems), and any system that does not pass the test is to be cleaned (per current edition of NADCA ACR), at no additional cost to the Owner. For early start-up operating conditions occurring in excess of (3) three months time period prior to Owner acceptance of the project, the Contractor shall complete the following minimum scope upon Owner acceptance:

1. Replace v-belts of operating belt drive fans.
 2. Lubricate operating rotating equipment.
 3. Perform any equipment manufacturers recommended scheduled maintenance which is due to occur within 3 months time period after Owner acceptance.
- C. For existing systems, the Contractor shall evaluate the condition of each HVAC system piece of equipment to ensure it is in proper working condition per the most recent building design drawings (request from Architect as required). This shall include but not be limited to verifying all air flow(s) and water flow(s) are achievable through a preliminary test and balance report. Should deficiencies be found by the Contractor, the Architect shall be immediately notified by a written report which shall include all findings and photos of existing conditions. Should the Contractor fail to perform the preliminary equipment assessment, all cost associated with ensuring the HVAC systems operate as specified and intended, shall be the Contractors responsibility.

PART 2 - PRODUCTS

No products are specified under this section of the Specifications.

PART 3 - EXECUTION

3.01 REVIEW OF EQUIPMENT AND MATERIALS

- A. Within fifteen days of award of the contract, the Contractor shall submit a digital copy (PDF format) of manufacturers' data and descriptive literature and drawings for all equipment and materials. All literature and data on all equipment shall be submitted at the same time: this material shall contain complete capacity data, curves, dimensions and all other pertinent information necessary for the Architect to properly evaluate the item. No item of equipment or material shall be placed on order until Final Review comments are received from the Architect. In the event the Contractor submits equipment requiring revisions to others work, including but not limited to electrical service or structural supports, other than that shown in the Drawings and Specifications, the Contractor shall bear all costs of the necessary revisions.

3.02 COORDINATION OF TRADES

- A. Where work is in close proximity to the work of other contractors, the Contractor shall review plans of other contractors and coordinate his work with theirs. The Contractor shall verify the location of lighting fixtures, beams, conduit, pipes and other obstructions before beginning his work in the area. Notify the Architect where proper clearances do not occur or where the work of others would interfere with the safe and/or proper operation of this work.

3.03 START-UP AND INSTRUCTIONS

- A. The Contractor shall furnish qualified personnel to start-up the installation and to train the Owner's operator in operation of the system.

3.04 BALANCING AND OPERATING TESTS

- A. The Contractor shall procure the services of an independent Testing and Balancing Agency, approved by the Architect and specializing in the balancing and testing of HVAC systems. Contractor shall coordinate all activities of the Testing and Balancing Agency and other sub-contractors affected throughout the balancing process. See "FINAL COORDINATION."
- B. The Testing and Balancing Agency shall balance, adjust and test all air and all water equipment and distribution systems as herein specified. The work shall include verifying the function of all modes of operation. All work by this agency shall be done under direct supervision of a qualified HVAC Engineer employed by the agency. All instruments used by this agency shall be accurately calibrated and maintained in good working order.
- C. It is the responsibility of the Testing and Balancing Agency to test, adjust, and verify the operation of all items of the air and water distribution systems.
- D. Testing and Balancing Agency shall not begin until all systems have been completed and are in full working order and in full operation. Systems found out of calibration, missing, broken or otherwise inoperative shall be listed and a report of initial testing shall be submitted to the Contractor and to the Architect. Balancing and testing shall resume after all items are in full operation. Obtain test kits, probes and other accessories necessary to do the work.
- E. It is the responsibility of the Testing and Balancing Agency to test and verify that the complete cycle of operation of all equipment, heating, cooling, smoke, and exhaust modes is operable as per these Specifications.
- F. If requested, the tests shall be conducted in the presence of the Architect.
- G. Air balance work shall include additional adjustment of components during the season following the initial balance to include rebalance of any items influenced by the season changes or directed by Architect.
- H. The scope of the balancing and operating tests shall apply to all new work and shall also apply to the existing systems where any changes are being made in this project.
- I. Balance Report: Submit a digital copy (PDF format) of final balance report. Comply with review comments made by Architect and re-balance and resubmit as required.
 - 1. Warranty: Testing and Balancing Agency shall include an extended warranty of 90 days, after completion of test and balance work, during which time the Architect at his discretion may request a re-check, or resetting of any outlet, supply air fan, or exhaust fan as listed in test report. The agency shall provide technicians to assist the Architect in making any tests he may require during this period of time.
 - 2. Air Systems: The Testing and Balancing Agency shall perform the following test of each air unit and fan system and balance the systems in accordance with the following requirements:
 - a. Test and adjust RPM to design requirements.
 - b. Test and record motor full load amperes.
 - c. Make pitot tube traverse of main supply ducts and obtain design CFM as required.
 - d. Test and record system static pressure, suction and discharge.

- e. Test and adjust system for design return air CFM.
- f. Test and adjust system for design outside air CFM.
- g. Test and record entering air dry bulb and wet bulb temperatures.
- h. Test and record leaving air dry bulb and wet bulb temperatures immediately after cooling coil and at air unit discharge within 2'-0" of unit casing.
- i. Adjust all main supply and return air ducts to proper design CFM.
- j. Test and record electric duct heaters and heat strips of air unit systems voltage and amperes, each step.
- k. Test and adjust each diffuser, grille, and register to within 10% of design requirements. Readings and tests of diffusers, grilles, and registers shall include required CFM and test resultant CFM after adjustments.
- l. All diffusers, grilles, and registers shall be adjusted to minimize drafts in all areas.
- m. As part of the work of this contract, the Contractor shall make any changes of any air unit in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by Air Balance Agency, at no additional cost to the Owner.

3. Variable Air Volume (VAV) Terminal Units: The Testing and Balancing Agency shall perform the following tests to each variable air volume terminal unit:

- a. Test, adjust and calibrate the maximum, heating, ventilation minimum and unoccupied, air quantities.
- b. Ensure the entering static pressure is sufficient for normal, proper unit operation.
- c. Set the thermostat and unit pressure controllers for proper heating, cooling, and unoccupied setpoint operation.
- d. On VAV units with electric re-heat coils, balance and re-set minimum air flow for safe minimum air flow over the coils.
- e. Test and record VAV unit electric heat voltage and amperes, each step.
- f. Readjust all terminal units supply systems as required such that all outlets of a unit simultaneously reach design values.
- g. Verify that at project acceptance all construction phase filters at the inlet to fan powered terminal units have been removed (and remove if necessary).

4. Kitchen Hood Testing:

- a. General: The Test and Balance Agency shall test and adjust kitchen hood total air flow by duct Pitot-tube traverse. (See welded hex nut in Section 23 00 20, "KITCHEN HOOD EXHAUST AND DISHWASHER EXHAUST DUCTWORK".) The Test and Balance Agency shall test and record face velocities in accordance with design requirements. It shall test and adjust makeup air flow to meet design face velocities and pressurization and to minimize turbulence. Kitchen shall have negative pressure with respect to rest of building, but positive to the outside, ambient environment.

5. Building/Zone Pressurization Testing:

- a. The Test and Balance Agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differential. For positive pressure areas, it shall set the supply air to design flow, and gradually reduce the exhaust air rate to obtain the

required flow or pressure difference. For negative pressure areas, it shall set the supply air to design flow, and gradually increase the exhaust air rate to obtain the required flow or pressure difference.

6. Smoke Damper Testing:

- a. The Contractor shall test smoke dampers (including combination fire/smoke dampers) in the presence of the Test and Balance Agency to assure proper operation. They shall verify that an access door has been installed for each fire and smoke damper. For each smoke damper, the Contractor shall open the access door, activate the damper, and observe operation. The damper must close quickly and completely. The Contractor shall then reset the damper and observe its complete opening.

7. Stairwell Pressurization:

- a. The Test and Balance Agency shall test and adjust stairwell pressurization system to provide design air flow into the stairwell and set reliefs to maintain required pressurization. When required by the local authority, it shall check door pull force on all exit doors to specified requirements. Test with and without available generator power.

- 8. Final Coordination: The Contractor shall provide for final coordination with balancing sub-contractor, control sub-contractor and other affected sub-contractors. After occupancy, Architect shall have the option of revising criteria to satisfy occupant comfort.

3.05 SITE CONDITIONS

- A. The Contractor shall visit the building site to determine existing conditions and shall be held responsible for allowing for these conditions in his bid. This will include above or below grade items that may affect the work.

3.06 EXISTING BUILDING CONDITIONS

- A. Note that this area of work has existing storm drainage, mechanical, plumbing and electrical utilities located underground and within and under the building. It is part of this work for the Contractor to determine the scope and location of all existing utilities and the scope and location of all new utilities to be installed concurrent with this project and to arrange his work around others.
- B. Contractor shall not excavate or demolish without first ascertaining the location of underground public utilities by serving telephonic notice to a regional notification program. In the State of Louisiana, the regional notification program is Louisiana One Call.
- C. Contractor shall inspect all existing conditions and space limitations at the site and shall include in his bid all required special adjustments because of site conditions. Verify conditions during construction before fabrication of system components. Early fabrication will not be justification for extra payments for changes due to job conditions.

3.07 SALVAGEABLE MATERIALS

- A. The Owner shall have priority for the selection of the salvageable materials and equipment from the building. Any equipment and materials selected to remain the property of the Owner shall be removed and delivered to a location on the building site as designated by the Architect. All other materials shall be legally and properly disposed of. Provide written documentation, receipts and information indicating the materials, disposal site and date.

3.08 SHUT DOWN OF EXISTING SERVICES

- A. Where existing HVAC systems are to remain operational during construction, all interruptions of such systems shall be held to a minimum reasonable time. Coordinate outages using a written request to the Architect through the General Contractor. Request shall be submitted to the Architect at least 72 hours prior to outage time requested.

END OF SECTION

SECTION 230010 - HVAC BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 LABELS

- A. Provide a label on each piece of apparatus and each controlling device. Labels shall identify item and number and have identifying function and position settings. Labels shall be pressure sensitive adhesive mount type, 1/16 inch minimum thickness, engraved type laminated plastic, black with white lettering.
- B. Provide labels on the ceiling where valves, accessories, equipment, etc. exist, for easy identification by maintenance staff. Labels shall be of the permanent type, with 1/4" high white background and 1/8" high black lettering. Submit to Architect for review.

1.02 PIPING IDENTIFICATION

- A. Provide markers on piping which is either exposed or concealed in accessible spaces, with Seton Setmark, EMED Co. Kwik Koil, or equal plastic snap-around markers. For insulated piping, markers may be Seton Opti-Code, EMED Co. Econo Mark pressure sensitive vinyl markers with matching self-adhesive "arrow" banding tape applied circumferentially at each end of marker. For piping systems, other than drain and vent lines, include generic name of system or its abbreviation by pre-printed markers, and include arrows to show direction of flow. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50 feet maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required. Markers shall comply with ANSI A13.1 Standard.

1.03 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
 - 1. Supply Air Ducts for Cooling and Heating: Blue with text "SUPPLY AIR".
 - 2. Return Air Ducts for Cooling and Heating: Yellow with text "RETURN AIR".
 - 3. Outside Air Ducts: Yellow with text "OUTSIDE AIR".
 - 4. Relief Air Ducts: Green with text "RELIEF AIR".
 - 5. General Exhaust Air Ducts: Green with text "EXHAUST AIR".
 - 6. Hood Exhaust Air Ducts: Yellow with text "EXHAUST AIR".
 - 7. Hood Make-Up Air Ducts: Yellow with text "SUPPLY AIR".
 - 8. Letter Size: One inch minimum for principal lettering and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. For VAV (low pressure) supply air zones, indicate terminal unit designation.
- C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.
- D. Duct markers shall be color coded plastic or vinyl with contact-type permanent adhesive. Include air flow direction arrow and duct service identification.

1.04 VALVE IDENTIFICATION

- A. General: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment unit and faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide shape-coded and stamped brass tags on chain or S-hook fasteners. Tags to be 0.032 inch thick brass with minimum 1/4 inch high letters.

1.05 VALVE SCHEDULE

- A. For each piping system, on standard-size bond paper, tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed or modulating) and variations for identification. Each schedule to be framed in an extruded aluminum frame suitable for mounting on masonry walls. Mount in equipment rooms or as directed by the Architect.

1.06 MATERIALS IN AIR DUCTS AND PLENUMS

- A. No plastic or other non-metallic materials as defined by NFPA 90A shall be used in air ducts or plenums unless specifically rated for such service.

PART 2 - PRODUCTS

2.01 MOTORS AND MOTOR STARTERS

- A. Electric motors with characteristics as shown on the Drawings shall be provided by the Contractor for all pieces of driven equipment. Electric motors shall be submitted for approval and shall conform to the following: Single phase motors shall generally be as recommended by the manufacturer of the driven equipment. Three phase motors shall be squirrel-cage induction type motors unless otherwise specified. Motors shall have characteristics as listed on the Drawings and shall be selected to be non-overloading and capable of normal scheduled operation without requiring operating in the service factor range. Motors shall be designed for a 40°C rise from 40°C ambient and shall have NEMA design B normal starting torque unless otherwise specified. Enclosures shall be open, drip-proof for all applications not exposed to outside weather conditions and totally enclosed, fan-cooled for motors located outside, or exposed to outside conditions. All motors shall be rated at full load conditions and be high efficiency, high power factor type, copper wound, premium grade, and shall comply with the Louisiana Building Energy Conservation Code and based on ASHRAE 90.1 -2007 with all addenda. Motor shall comply with Energy Independence and Security Act (EISA) of 2007 (NEMA MG-1 Tables 12-1 and 12-2).
- B. Motors used for inverter service shall have a split ring grounding mechanism that shall ground the rotor shaft to prevent inverter induced voltages from pitting the bearings. Systems by Aegis acceptable.
- C. In addition, motors for inverter, variable frequency drive use shall be definite purpose inverter fed motor rated NEMA MG-1, Part 31 compliant and rated to withstand voltage peaks of 1600 volts at a rise time of 0.1 microseconds as a minimum.
- D. Motor starters for factory assembled units shall be provided for by the manufacturer and be completely factory wired and mounted. All contactors to be NEMA rated and generally conform to the specifications below. All separate motors and motors not otherwise packaged with a starter unit as part of a factory assembly shall have a starter as specified below. Provide labels for each starter: white etched letters on black laminated plastic base.

- E. Manual starters for single phase motor applications shall be magnetic start type with operating pilot light, thermal melting alloy overloads, one per phase, Square D Type 3536, Allen-Bradley Bulletin 509, Cutler-Hammer Freedom Series, General Electric CR101, Siemens-Furnas 14 Series or equal as listed by addenda.
- F. Where starters for single phase motor applications call for magnetic type starters, they shall be full voltage, non-reversing combination magnetic motor starter disconnect type with adjustable trip motor-rated circuit protector. Starter shall be NEMA rated and shall have a thermal melting alloy overload, one per phase, operating pilot light and shall have auxiliary contacts as required for interlocking. Any and all indicating pilot lights, diagnostic lamps, etc. shall be LED type with color as standard; do not use incandescent lamps. Overload relays shall be NEMA Class 10 for HVAC compressor use, Class 20 for fan and pump use and Class 30 for high starting torque use. Units shall be Square D Class 8539 with motor logic Class 9065, Cutler-Hammer Freedom Series with CEP7, Siemens-Furnas Class 14 Series, with ESP 200, General Electric CR101 Series, Cerus BAS-1P Series or equal as listed by addenda.
- G. Each three phase electric motor shall be provided with a full voltage non-reversing combination magnetic motor starter disconnect type with adjustable trip motor rated circuit protector unless noted otherwise on Drawings as furnished elsewhere. The starter shall be NEMA rated and have solid state overload relays, one for each leg and shall have a minimum of two each NO and two each NC auxiliary contacts as required for interlocking. Overload relays shall be NEMA Class 10 for HVAC compressor type use and Class 20 for fan and pump use. Use NEMA Class 30 overload relays only for high starting torque use. Units shall be Square D Class 8539 with motor logic class 9065, Cutler-Hammer Freedom Series with CEP7, General Electric CR387/487 Series Siemens-Furnas 18 Series with ESP 200, or equal as listed by addendum.
- H. Enclosures for combination starters shall be NEMA 1 general purpose for all indoor applications and NEMA 3R rainproof for all applications exposed to outdoor conditions. Provide mechanical operators capable of being locked. Each shall be rated 10K AIC minimum and shall have a hand-off-automatic switch and operating pilot light with push to test lamp feature mounted in the face of the enclosure. Any and all indicating pilot lights, diagnostic lamps, etc. shall be LED type with color as standard; do not use incandescent lamps. Provide fused control voltage transformer 100VA minimum size for 120 Volt or lower coil controls. Unit shall include a factory wiring block for field extension. No wire nut connections allowed. Verify with Temperature Control requirements. Submit shop drawings on all starters and switches.
- I. Motor starters for motors 25 HP and less shall have a line power monitor to protect the motor from overcurrent and voltage and loss of phase protection. Include with starter, factory wired and UL listed.
- J. Motors and motor starters 30 horsepower and larger are to be of the reduced voltage, solid state soft start type.

2.02 VARIABLE FREQUENCY DRIVES (VFD)

- A. The Contractor shall supply a variable frequency, variable torque, Alternating Current, solid state, induction motor speed controlling Variable Frequency Drive (VFD) for each variable speed application (i.e., AHU's, pumps, fans, etc.) where shown on Drawings. Controllers shall be Yaskawa Z-1000 Series, Fuji AF-300-F11 Series, Danfoss VLT Series, ABB ACH-550 Series, or equal as listed by addendum. All drives for this project shall be by the same

manufacturer. The speed controller, the bypass switch, contactor and controls shall be by the same manufacturer, factory installed, and be self-contained, totally enclosed in a single convection cooled NEMA cabinet. For drives installed interior to buildings, cabinets shall be NEMA 12, rated for operation between 0°C and 40°C. For drives installed exterior to buildings (and/or exposed to outdoor environments), cabinets shall be NEMA 3R, rated for operation between -12°C and 48°C. The unit shall be fully rated for the horsepower of the motor connected at the voltage specified.

- B. VFD shall include all necessary motor starter functions. Unit shall have a loss of phase protection to prevent drive operation on loss of phase. Threshold on phase monitoring shall be adjustable. Provide external to the drive unit a three-contactor manual power bypass arrangement to manually bypass the variable speed controller. The controller shall be out of the circuit when in the bypass mode. The unit shall have full power for 100% motor speed while variable speed drive is removed. The manual bypass switch to be a switch to operate fully NEMA rated bypass contactors that will transfer the input power to the motor starter circuit and allow complete removal from the enclosure of the drive electronics package in an energized state. For units serving air units, manual bypass shall have auxiliary contacts for connection by the Temperature Controls Contractor, such that in the bypass position, the contact makes and all VAV boxes go to full open. In the bypass position, all start, stop, auto functions will be connected and maintained. In the normal position, bypass starter, overloads and controls are deactivated and the load of the motor is transferred to the output of the variable frequency drive.
- C. Provide an interface card such that the unit will transmit to the BMCS status and diagnostic information.
- D. The physical size of the unit shall be verified by the Contractor to physically fit the space allowed before bid. Units that do not fit or do not comply with Code clearances will be rejected. The bypass arrangement, drive and cabinet shall be a single source responsibility and be manufactured and factory supplied by the drive manufacturer. No shop assembled or field fabricated assembly of components is acceptable.
- E. Input voltage of the unit shall be the same as the voltage required by the motor. No voltage level transformation is allowed unless specifically noted otherwise. The unit to be capable of input voltage variations of $\pm 10\%$, 3 phase, and frequency $\pm 2\%$ at rated voltage and 60 Hz.
- F. The output voltage to vary from zero to the rated motor voltage, and the output frequency to vary from zero to 120 Hz minimum. The output voltage-frequency combination shall ensure the optimum volts per Hertz ratio for best operating efficiencies and minimum motor heating. The output must be a voltage source type generating a sine coded PWM waveform utilizing an asynchronous carrier frequency. This carrier frequency shall be adjustable to minimize harmonically induced noise or vibration. This must be accomplished using a microprocessor based technique which forms a true sine coded current waveform to the motor for smooth performance at all speeds.
- G. The VFD shall provide the necessary conversion and control of incoming line voltage to the variable frequency, variable voltage output via the following general scheme:
 - 1. The power input stage shall convert three-phase AC line power to a fixed DC bus voltage. Provide a solid state three-phase full wave diode rectifier with metal oxide varistor (MOV) three-phase protection. Minimum full load power factor shall be 0.90. Drive shall not cause voltage line notching nor introduce noise to the mains.

- H. The drive shall not produce more than 5% total voltage demand harmonic distortion (THD), voltage as measured on the line side of the drive. Provide for DC bus reactor in the positive line of the DC section of the drive. Locate in the drive cabinet.
- I. Provide for a factory trained service technician to supervise start-up of each motor speed controller.
- J. Once the DC bus voltage is established, the power is internally delivered to the intermediate stage. The intermediate power stage shall be interfaced with the drive's diagnostics to provide continuous monitoring for the drive power component protection. The DC bus shall be fused for short circuit power protection. The DC bus shall have capacitive filtering to provide smooth DC power to the output power stage. The power is then routed to the drive's output stage.
- K. The drive's output stage shall utilize switching transistors to convert DC bus power to sine-coded or voltage-vector pulse width modulated (PWM) voltage source power for motor control. Current transformers (CT's) shall be utilized to detect the output current of all three phases to the motor.
- L. The drive shall have a 4 to 1 speed range as a minimum. The unit must be specifically designed for Air Handling unit service and be matched to the motors of the unit, size and characteristics scheduled and as specified herein. Unit must be solid state, microprocessor controlled, and use the pulse-width modulated technology to remanufacture the output waveform.
- M. The VFD shall be automatically controlled by a DC control signal. The DC control signal shall either be 4 - 20 ma or 0 - 10 volts. Manual operation capability must be provided. Provide integrated Metasys N2, Modbus or BacNet connectivity.
- N. VFD must provide for a slow speed start (soft start) with adjustable starting frequency. Minimum and maximum speed shall be capable of adjustment.
- O. VFD shall have built-in current limiter with automatic shutdown if motor current exceeds 110% of design, but will allow momentary overloads of 150% of design current. Set at start-up for actual motor nameplate rating.
- P. The VFD shall provide simple connections for interface with the temperature controls panel, the fire alarm system, and equipment safety cut-outs. A visible front mounted indicator light must indicate if fire, smoke or freeze conditions have shut down unit.
- Q. VFD must be capable of running through momentary power outages up to 5 cycles in duration. Unit will shutdown if power fails for greater than 5 cycles but will automatically restart when power is reapplied.
- R. Provide for a factory trained service technician to supervise start-up of each VFD. This is mandatory and is to be part of the overall instructions to the Owner. Schedule through the Architect.
- S. The VFD must meet the following Specifications in operation:
 - 1. Instantaneous shutdown on current overloads in excess of 150%.
 - 2. Momentary current overload capability up to 120% for 60 seconds (adjustable).

3. All control circuitry must be electrically isolated from inverter logic and power sections.
 4. Output shall be current limited.
 5. Current limiting fuses shall be supplied on AC input lines.
 6. Shall have under-voltage, over-voltage, loss of phase, over-temperature, short circuit, DC bus and electronics protection.
 7. Built-in motor stall protection.
 8. External to drive unit bypass switch for emergency motor operation in case of unit failure. Provide 3-contactor isolating bypass arrangement with separate set of thermal motor overload relays **and** full size NEMA rated motor starter for operation in the bypass condition. See Temperature Controls and above. Bypass switch shall include the fully NEMA rated external bypass motor starter, NEMA rated bypass contactors, overloads and disconnect switch. In lieu of the drive input contactor, a fully rated service disconnect switch is acceptable. This switch must be internal to the NEMA cabinet (see Paragraph A, above) and labeled "SERVICE DISCONNECT."
 9. Provide Hand-Off-Auto switch with manual speed potentiometer on the unit. This Hand-Off-Auto switch is to be operable in both the normal and bypass position.
 10. Provide unit mounted disconnect switch operable in the normal condition or bypass position. If a thermal-magnetic circuit breaker is used as the system disconnect switch, it shall be sized for across-the-line starting of the motor when in the bypass position.
 11. Input electrical lug and output electrical lugs shall accommodate the wiring type, number per phase and size as per the Drawings.
 12. Cabinet assembly with drive and all components to have lockable door with all normal operating controls on the door face and be NEMA constructed (see Paragraph A, above).
 13. Ground fault protection trip out.
 14. Adjustable accelerating and decelerating time.
 15. Built-in diagnostics and indicators to provide fault condition trouble shooting by field personnel without the use of external measurements.
 16. Any and all indicating pilot lights, diagnostic lamps, etc. shall be LED type with color as standard; do not use incandescent lamps.
- T. The overall noise level of the unit and motor combination must be acceptable to the Owner. Noisy units or motors that produce objectionable noise under normal operating conditions as judged by the Architect shall be replaced or repaired with quieter units at no cost to Contract.
- U. Refer to Drawings for additional work. The Electrical Contractor is to provide for all power wiring with the Temperature Controls Contractor providing the interlock wiring, the interface and interlock devices, and all pneumatic work.

2.03 INSULATION

- A. Submittals: Submit product data under provisions of Section 230000. For each type insulation system, product data shall identify thermal conductivity, water-vapor permeance, thickness, jackets (both factory and field-applied if any), plus applicable coatings/sealants/adhesives. For each piping system, ductwork system and equipment to be field insulated, provide description (and/or sketches) identifying the insulation system to be installed; this description (for each applicable piping/ductwork/equipment component) shall identify the insulation thicknesses to be utilized, jacketing (if any), coatings/sealants/adhesives, and installation procedures.
- B. All surfaces shall be clean and dry when covering is applied. Covering shall not be applied before piping and equipment have been tested and proven free of leaks. On piping

carrying cold fluids, the covering shall pass full thickness through or over hangers and the Contractor shall provide a galvanized steel bearing plate at each support:

<u>Pipe Size</u>	<u>Plate Length</u>	<u>Plate Gauge</u>
Up to 4 Inch	12 Inches	16
5 and 6 Inch	18 Inches	16
8 Inch to 14 Inch	24 Inches	14
Above 14 Inch	24 Inches	12

- C. Plates shall be formed to fit the outside of covering and shall extend halfway around the covering. All plates, sleeves and hanger devices to be sized and applied without damaging or deforming the insulation or puncturing the vapor barrier.
- D. For the purposes of this specification, the term "attic" refers to the cavity space between the roof deck and the insulation level at the ceiling line. If all of the insulation is at the roof level, with no insulation at the ceiling line, then the cavity space is not an attic.
- E. Unless indicated otherwise, all insulation installed within the building enclosure(s) shall have a composite (insulation, jacket and adhesive, as applicable) flame spread index of 25 or less and a smoke-developed index of 450 or less, unless required otherwise by local Codes and International Building Code 720. Insulation within air ducts, plenums or other similar compartments used as part of an air distribution system shall be of materials approved for plenum service and shall have a flame spread index of 25 or less and a smoke-developed index of 50 or less, as per NFPA 90A and International Mechanical Code 602. Plastic materials are not allowed in plenum spaces unless specifically rated for such service.
- F. For interior evaporator condensate drain piping, horizontal runs of above grade waste piping carrying cold fluids or evaporator condensate, refrigerant suction piping, and refrigerant hot gas reheat piping, insulate with flexible elastomeric cellular (foam) insulation applied by the slip on method with glued and sealed joints. Insulation shall be 3/4" thickness except shall be 1/2" thickness for refrigerant hot gas reheat piping. Where routed within a return air environment, insulation shall have an acceptable composite flame and smoke rating. For outdoor applications, insulation shall be covered with outer jacketing of multi-ply zero permeable embossed aluminum sheeting material (nominal 7 MILS thickness), VentrueClad 1577 CW Series, Ideal Tape Co., Inc. IdealSeal 777, Polyguard Alumaguard LTE Series or equal as listed by addendum; install sheeting material in accordance with manufacturer's installation requirements
- G. Cover all straight runs of all outdoor piping insulation other than flexible elastomeric cellular (foam) insulation with 0.016 inch thick smooth aluminum jacket using strap method as recommended by the manufacturer. The aluminum jacket shall be in addition to the previously specified jackets. Fittings for piping receiving aluminum jacket shall be covered with pre-formed aluminum jacketing. Seal all joints and seams with silicone based caulking.
- H. Insulate all unlined supply ductwork including flexible duct connections on fan/blower coil units, and heating coils at discharge of VAV terminal units, return air ductwork, outside air ductwork, exhaust ductwork and all lined ductwork routed in attics or unconditioned spaces, with flexible fiberglass blanket insulation with foil-scrim-kraft (FSK) vapor barrier facing. Insulation shall be no less than two 1-inch minimum thickness, as necessary to obtain a minimum R-value of 6 (install at 25% compression). Staple joints and apply pressure-sensitive tape (matching the insulation facing and designed for use with the insulation) all around joints and at longitudinal seams. Where insulation is applied to oval or rectangular ducts with horizontal

dimension greater than 24 inches, provide clips on the underside at 18 inches on centers both ways. Refer to Section 230020 for additional information.

- I. For ductwork exposed to the weather, insulate with one layer of 2 inch thickness foil-faced foam sheathing board insulation (Johns Manville AP™) consisting of a uniform closed-cell polyisocyanurate foam core bonded on each side to a foil facer applied with manufacturer's recommended contact adhesive and overlapping joints. For the top surface of the insulation, cover entire top surface of insulation with 20-gauge aluminum sheet metal with mechanically bent (2") sidewalls as reinforcement to avoid physical abuse of the top surface. Insulation (including the sheet metal top cover) shall be wrapped with an outer jacketing of multi-ply zero permeable embossed flexible aluminum sheathing material, Polyguard Alumaguard; install sheeting material in accordance with manufacturer's installation requirements for a weathertight installation (see additional requirements below).
- J. Where noted on drawings, insulate exhaust ductwork with a Morgan Thermal Ceramics FastWrap XL for Exhaust Systems or Unifrax FyreWrap Duct Insulation System listed by a NRTL, nationally recognized testing laboratory and ASTM E2336 Testing for Grease Duct Enclosures. Insulation system shall include two layers of 1-1/2 inch thickness foil encapsulated duct wrap insulating material, filament tape, banding material, insulation pins and all accessories required for a complete UL classified ASTME-119 Test, ASTME-2336 for 2 hour rating in exhaust duct applications. Insulation shall pass full thickness through floors, walls and roofs, and into roof curbs. Where duct penetrates floor, provide through floor insulation and 1/2 inch angle steel members at floor. Wrap material shall be butt joint on the first layer and overlapped on second layer or as per manufacturers recommendations. Install insulating system in strict accordance with manufacturer's requirements for zero 2-hour fire rating application. Access doors shall have 3 layers of insulation material sealed and fastened as per manufacturer's recommendations. Include threaded rods, spool pieces, washers, fasteners and 16 gauge door insulation outer (cover) plate, label insulation cover as "ACCESS DOOR".
- K. Insulate tops of air diffusers occurring in either spaces not conditioned or spaces not part of a return air plenum. Insulation shall be flexible fiberglass blanket insulation with foil-scrim-kraft (FSK) vapor barrier facing. Insulation shall be no less than two 1-inch minimum thickness, as necessary to obtain a minimum R-value of 6 (install at 25% compression). Overlap diffuser 6 inches all around. Scribe to neck size and attach with aluminum tape.
- L. Where noted on drawings for sound sensitive spaces, provide acoustical lagging sound barrier wrap covering piping/ductwork. Acoustical lagging shall be Kinetics Noise Control KWM-100-ALQ, Sound Seal B-10LAG/ZFA-3, or approved equal sound attenuating lagging barrier wrap. The barrier wrap shall be constructed of a 0.12" (minimum) thick mass loaded, limp vinyl sheet bonded to a thin layer of reinforced aluminum foil on one side. The barrier wrap shall have a nominal density of 1.0-psf and shall have a minimum STC rating of 28. The barrier wrap shall exhibit minimum flammability ratings of 0.0-seconds for flame-out and after-glow, and 0.2" for char length when tested in accordance with Federal Test Std. No. 191-5903. The barrier wrap shall have a minimum thermal conductivity (K) value of 0.29 and a rated service temperature range of -40°F to 220°F. When tested for Surface Burning Characteristics per ASTM E84, the barrier will have a Flame Spread Index of no more than 10 and a Smoke Development Index of no more than 40. The decoupling layer shall be a combination of 1.0" fiber glass batting, non-woven porous scrim-coated glass cloth, quilted together in a matrix of diamond stitch pattern which encapsulates the glass fibers. Sound control lagging material shall be cut to length, wrapped around the outside of the pipe or duct, and fastened with mechanical fasteners or bands. Tape and adhesive can be used in conjunction with mechanical fasteners or bands. All sound control lagging materials must be installed per the manufacturer's installation guidelines.

- M. In each mechanical room containing air handling units, provide rigid sound insulation board on interior walls of mechanical room; exterior walls do not require sound insulation. Insulation shall be 2 inches thick, 3-pound density, semi-rigid fiberglass board faced with spray-on surface treatment (for exposed surface), Knauf rigid plenum liner, or equal, with 0.95 Noise Reduction Coefficient (NRC). Install board on walls (only) of mechanical equipment room in a neat, workmanlike manner, secured with 12-gauge pins (attached to the wall with suitable "Miracle" adhesive and round locking washers approximately 12 inches on center. All butt joints of board shall be covered with mastic to match the surface treatment.
- N. Insulation materials shall meet the following minimum standards:
 - 1. Molded glass fiber piping insulation/jacketing: ASTM C 547, TYPE 1, 0.24 K-factor (at 100°F mean temperature) insulation material with ASTM C1136 jacketing. Knauf Earthwool 1000°, Johns Manville Micro-LOK HP, Owens Corning SSL II, or equal as listed by addendum.
 - 2. Flexible elastomeric cellular insulation: ASTM C 534, TYPE I (for Piping), ASTM C 534, TYPE II (for Sheets)
 - 3. Flexible fiberglass ductwork insulation: ASTM C 553, TYPE I, CLASS B-4. Knauf insulation atmospheric duct wrap, Johns Manville Microlite EQ FSK, Owens Corning SOFTR duct wrap, or equal as listed by addendum.
 - 4. Cellular glass thermal insulation: ASTM C552
- O. Insulating materials shall be as made by Dow, Knauf, Owens-Corning, Pittsburgh Corning, Johns Manville, Armstrong, Nomaco, or equal as listed by addendum, and shall be installed as per manufacturer's recommendations.

PART 3 - EXECUTION

3.01 INSULATION INSTALLATION

- A. Insulation Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program for the insulation products to be installed. Installers for an insulation product may be skilled mechanics who have successfully completed an insulation product manufacturer's installation training program for that product, (such as the Armacell Qualified Installer Program) and have been given a certificate of completion from that product manufacturer. The insulation installer must be licensed in the state of Louisiana by the State Licensing Board of Contractors in the classification of Specialty Insulation (Commercial and Industrial) or have a minimum of 5 years' experience in the field of Commercial Insulation.
- B. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.
- C. Install insulation materials, accessories, and finishes in accordance with manufacturers installation instructions for the intended applications, with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Install insulation continuously through hangers and around anchor attachments.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic. Also, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic
- L. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- M. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- N. Except where required otherwise by the manufacturer's installation instructions, install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on centers.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
 - 6. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
 - 7. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
 - 8. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

P. General installation requirements for flexible aluminum sheathing applied to exterior ductwork:

1. Install flexible aluminum sheathing in accordance with manufacturers installation instructions for the intended applications, with smooth, straight, and even surfaces; free of voids throughout the length of duct system, including fittings and specialties.
2. Ductwork must be sealed in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible - Second Edition (1995) Seal Class A (or latest version of SMACNA) prior to insulation of aluminum sheeting. Air leakage from ductwork can cause aluminum sheeting to balloon as it totally seals the insulation system.
3. All flexible aluminum sheathing products will be installed on ductwork insulation which is pitched to shed water and prevent water ponding on top of the duct.
4. Contractor is responsible for testing adhesion to any substrate. Substrate surface must be clean, dry, and free of oil films.
5. On ductwork to be weather protected by Polyguard Alumaguard, Polyguard Alumaguard Lite is to be installed on the bottom side of the duct.
6. Flexible aluminum sheathing shall not be pre-applied to fabricated insulation sections. The aluminum sheathing is not a mechanical fastening system and cannot be relied on to secure the insulation.
7. Flexible aluminum sheathing is to be installed such that bottom (underside of ductwork) is installed first (with 6" overlap of bottom edges), followed by the sidewalls then the top, as per manufacturer's installation instructions. Overlap joints/seam to permit water shedding over the lapping. Care must be used to ensure that the fittings are vapor sealed. Roll the sheathing with laminate roller while removing the release film to insure adhesion to the substrate.
8. Contractor is to arrange inspection of flexible aluminum sheathing by manufacturer's representative to validate manufacturer's product warranty Obtain written confirmation from aluminum sheathing manufacturer that completed installation meets manufacturer's installation requirements and provide manufacturer's ten-year warranty, from date of Substantial Completion.

Q. General pipe insulation installation requirements:

1. Requirements in this article generally apply to all insulation materials except where more specific requirements are noted above or by the manufacturer's installation instructions.
2. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - a. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - b. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - c. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

- d. Except as noted above for chilled water and heating water piping valves, insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - e. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - f. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - g. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
3. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
4. For flexible elastomeric cellular (foam) piping insulation, install insulation system in accordance with manufacturer's installation instructions and ASTM C 1710, plus the following:
- a. Slide un-slit sections over the open ends of piping or tubing; (slide on) insulation shall be pushed onto pipe, not pulled. Alternatively, slit tubular sections and apply onto piping or tubing; slit tubular insulation shall be installed with longitudinal seams at top of horizontal runs.
 - b. Insulation shall be mitered, pre-adhered and longitudinally slit inside throat to fit over all tees and elbows or bends over 90°.
 - c. All butt joints and seams shall be adhered with full coverage of adhesive on both surfaces. Insulation shall not be stretched when adhering. Do not tape insulation joints.
 - d. At the beginning, at every 12 to 18 feet, and at the ends of piping runs, the insulation shall be adhered directly to the copper using a 2" strip of adhesive. Insulation should not be adhered to the pipe at the extreme low points in any piping run.
 - e. For piping systems with fluid temperature below 60 Deg F (such as chilled water piping, glycol cooling water piping, cooling coil drain piping, and refrigerant suction piping), factory fabricated insulated pipe supports shall be used at pipe hanger/clamp locations to prevent the insulation from compressing, while still maintaining continuous thermal barrier protection.

Aramafix Insulation Pipe Hanger (IHP) is basis of design for insulated pipe supports. Insulated pipe supports shall be comprised of a load-bearing rigid foam insert (PET (Polyethylene-Terephthalate) structural foam core, high-density polyurethane, or equivalent) with elastomeric foam collars. Insulated piping supports shall include a protective outer shell (such as, 30-mil thick painted aluminum). The insulated pipe support shall have with the same insulation thickness as the pipe insulation. All joints shall be sealed with contact adhesive. Saddles shall be installed under all insulated lines at locations where the hanger may move due to movement in the piping from expansion and contraction. However, for piping (nominal) 1" diameter or less, insulated pipe supports may be eliminated at hangers which have factory formed sheet metal saddles supporting the underside of the insulation.

3.02 SUPPORTS, FOUNDATIONS AND VIBRATION ISOLATION

- A. The Contractor shall, unless otherwise specified, provide all foundations, supports, etc., necessary for properly supporting his work and equipment furnished by him and shall furnish and install all isolation materials to prevent transmission of vibration to the building structure. Isolation of equipment as shown on Drawings is the minimum required and any additional isolation required to prevent transmission of vibration or sound shall be provided by the Contractor, in accordance with the equipment manufacturer's requirements. All floor mounted equipment shall have a 4 inch high minimum housekeeping concrete pad with 1 inch chamfered edges. For indoor slab mounted equipment, vibration isolation is required for all vibrating or rotating equipment.
- B. Where applicable, under no circumstances shall the Contractor attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems shall be approved by the Architect. All supplemental angle or channel iron required to support equipment of this Specification shall be furnished by the Contractor and shall be independent of any other supports.
- C. Supports for ductwork, piping, conduit and equipment exceeding 200 pound load suspended from overhead construction in concrete shall incorporate steel imbedded anchors into the concrete pour. Use stainless steel expansion anchors only for loads less than 200 pounds per anchor and only in non-post tensioned slabs. For post tensioned slabs use imbedded support plates only.
- D. For slab mounted equipment, provide rubber mounting pads at each corner and under the support rails. For suspended units, provide combination rubber and captured spring isolators at each suspension point under the support base. Size and configuration shall be as required by the manufacturer for the intended use.
- E. Base-mounted or pad-mounted equipment specified herein or in the Drawings shall be installed at an elevation that is greater than or equal to the building's top of slab elevation, but in no case less than 1'-0" above the Base Flood Elevation (BFE) as designated by the Flood Insurance Rate Map (FIRM) for the geographical location of the project site.

3.03 OPENINGS, CUTTING AND PATCHING

- A. Cut all openings, as required, for the work under this subcontract. Patching will be done by the various crafts whose work is involved. Furnish and install all necessary sleeves, thimbles, hangers, inserts, etc., at such times and in such a manner as not to delay or interfere with the

work of other contractors. Seal, caulk and otherwise make air tight all duct and pipe penetrations through walls and floors. Caulk, flash or otherwise make weatherproof all penetrations through the roof and exterior walls. No pipe opening shall be sealed around the pipe or insulation without the penetration isolated from the wall system.

- B. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- C. For all openings larger than 16 inches horizontal dimension in existing masonry walls, provide 3 inch x 6 inch x 1/4 inch steel angle lintel with 8 inch minimum bearing length extending beyond each side of opening.
- D. All openings shall be protected by a rated protection system listed for the specific application for the type of material penetrating the fire barrier and the type of construction of barrier penetrated. Sealants used in floor penetrations shall be waterproof.
- E. Where piping, ductwork or other items that are provided for under this contract penetrate fire rated walls or floors, the Contractor shall seal around the item to maintain the integrity of the rated system. All openings shall be protected by a rated protection system listed for the type of material penetrating the fire barrier and the type of construction of barrier penetrated. Sealants used for floor penetrations shall be waterproof. Systems must be UL rated for two hours minimum. Submit proposed system for review. Provide documentation to the General Contractor and Architect for each type fire protection sealing system utilized in this project. The Fire Marshal Inspector may perform random destructive sampling of the sealant system installation; Contractor shall repair seal at sampling locations.
- F. For openings containing non-metallic material, piping, conduit or wiring, and penetrating a floor-ceiling assembly, the system shall include intumescent material and shall be a listed "through penetration" assembly tested in accordance with ASTM E-814.
- G. For precast concrete floor and wall systems, openings 8 inches round or 8 inches square and larger shall be by the precast concrete supplier. Openings smaller than 8 inches round or 8 inches square shall be by the Contractor and shall be core drilled or saw cut in the field.

3.04 ACCESS PANELS

- A. Access panels in ceilings and walls shall be steel doors with heavy duty concealed hinges of the pinless type and screw driver locks. Doors shall be prime coat finish.
- B. Provide access panels in the ceilings and walls for duct dampers, terminal boxes, coils, valves, etc. These access panels are for installation by others, but the Contractor is responsible for their proper location.
- C. Access panels in fire rated ceiling/walls shall be UL labeled to meet the requirements of the rated assembly and shall have a closer device to automatically close and latch the door upon release from any open position. Fire rated access panels shall have key operated locks with spare set of keys (turn over to Owner).
- D. Where lay-in ceilings exist, no access panels are required.

3.05 EXCAVATING, TRENCHING AND BACKFILLING

- A. Protect trench and handle materials in accordance with good safety practice. All pipes shall be installed with minimum 24 inch cover wherever possible and in no case less than 12 inch cover.
- B. The bottom of the trenches shall be accurately graded. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Wherever unstable soil is encountered, such soil shall be removed and the trench backfilled to proper grade with coarse sand or fine gravel.
- C. After all required tests and inspections have been performed, the trenches shall be carefully backfilled with materials approved for backfilling, deposited in 9 inch layers and thoroughly and carefully tamped. Repeat backfill as required after any subsequent settlement.
- D. For insulated chilled water and heating hot water piping installed underground (including underslab), trench shall be excavated to allow 6 inch minimum clearance all around the final outside diameter of the piping insulation. Provide sand bedding and backfill material to an elevation at least 6 inches above the top of the insulated piping. Apply bedding in layers as specified above. The remainder of the trench shall be backfilled with suitable material approved for backfilling. Temporary piping supports (such as concrete or timber blocking) required for the installation of the pipe and insulation within the trench shall be removed during the backfill sequence.
- E. Refer to other sections of this Specification for additional requirements for trenching, backfill, bedding, compaction, etc.

3.06 CLEANING

- A. When all work has been finally tested, remove construction debris from spaces containing HVAC equipment. Also, clean equipment exterior to remove construction dust/debris.
- B. All new piping, vessels and heat exchangers in the project shall be thoroughly flushed of all debris and foreign objects with appropriate fluids before systems are placed in operation. After flushing, all strainers and dirt traps shall be checked and cleaned.

END OF SECTION

SECTION 230020 - SHEET METAL WORK

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and erect in a neat, workmanlike manner all ducts and sheet metal work shown on Drawings. Verify all dimensions at the site, making all field measurements and shop drawings necessary before fabrication and erection of sheet metal work. Report any deviations to the Architect and obtain instructions before any ductwork is fabricated. Obtain approval of the Architect on all deviations from the contract Drawings and Specifications, as may be necessitated by job conditions otherwise. Unless noted otherwise, all SMACNA section, plate and table references are from SMACNA HVAC Duct Construction Standards, 3rd Edition, 2005. Conform to the requirements for metal thickness, reinforcing (types and intervals), tie rod applications (types and intervals), and joint construction (types and intervals).
- B. Ductwork shall be fabricated, and installed to provide an "Intermediate Level" of duct cleanliness in accordance with Appendix G (duct cleanliness for New Construction Guidelines) of SMACNA IAQ Guidelines for occupied buildings under construction, 2nd Edition. Site storage of ductwork shall be in a clean and dry environment and ductwork must be protected from the elements (such as, but not limited to rainwater, construction dust, and water ponding). If not suitably protected from construction debris contamination in accordance with the above requirements, the architect may require air handling units, ductwork and associated air distribution components to be cleaned or replaced (at the architect's discretion), at no additional cost to the Owner. Where interior metal surfaces must be cleaned to remove fabrication/installation residue, the surfaces shall be cleaned and sanitized by wiping with 10% bleach solution.

PART 2 - PRODUCTS

2.01 MATERIALS, GAUGES AND CONSTRUCTION

- A. Except as otherwise specified herein, or on Drawings, construct all sheet metal work of galvanized steel, lock-forming quality, ASTM A653/A653M, A924/A924M Coating Designation G90, as manufactured by U.S. Steel, Wheeling or Pittsburgh Steel.

2.02 SUBMITTALS

- A. Provide detailed CAD shop drawings of all sheet metal work drawn to the same scale and sheet size as the Contract Drawings. Indicate on each floor plan the duct sizes, fittings, building walls and partitions, floor penetrations, fire dampers, access doors, sizes and bottom elevations of all ducts, pressure classifications, terminal sizes and types, air quantities, room names and numbers. In addition to these floor plan drawings, include the following:
 - 1. Fabrication, assembly and installation details, including plans previously mentioned, sections, elevations, details of components and attachment to other work.
 - 2. Reinforcing details and spacing.
 - 3. Seam and joint construction details.
 - 4. Penetration through fire-rated and other partitions.
 - 5. Terminal unit, coil and humidifier installations.
 - 6. Hangers and supports, including methods for building attachment, vibration isolation and duct attachment.

- B. No sheet metal work shall be started without approved shop drawings.

2.03 PRIMARY SUPPLY AIR DUCTWORK

- A. Primary supply air ductwork shall consist of all supply air ductwork from air units to VAV and Fan Powered Terminal boxes. Rectangular primary supply air ductwork shall be constructed in accordance with SMACNA HVAC Duct Construction Standards, 3rd Edition, 2005, for 6 Inch Water Gauge Pressure Class. Unless noted otherwise, rectangular ductwork shall be 24 gauge **minimum** construction; provide reinforcement in accordance with Section I. **Transverse (girth) joints Type T-1 through Type T-14 shall not be allowed** for rectangular primary supply ductwork; instead use Type T-17 through T-22 and T-25b, as applicable, or Ductmate 35/25 System (with 440 Butyl gasketing) installed as per manufacturer's requirements. Unless indicated otherwise on Drawings, rectangular primary supply duct longitudinal seams shall be "Pittsburgh Lock" type, sealed with mastic sealant.
- B. Round and flat oval primary ductwork shall be constructed in accordance with Section 230021.
- C. Unless indicated otherwise, air velocity for ductwork shall not exceed 1,750 fpm for rectangular ductwork and 2, 250 fpm for round or flat oval ductwork..

2.04 LOW PRESSURE DUCTWORK

- A. All rectangular low pressure supply ductwork downstream from VAV terminal units, fan coil units, blower coil units, and all return, outside air and exhaust ductwork unless otherwise indicated shall be constructed in accordance with SMACNA HVAC Duct Construction Standards for 2 Inch Water Gauge Pressure Class. Unless noted otherwise, rectangular ductwork shall be **26 gauge** minimum construction; provide reinforcement in accordance with Section I.

2.05 KITCHEN HOOD EXHAUST DUCTWORK

- A. Ductwork shall be 18 gauge Type 430 stainless steel, double wall type, rated for zero clearance to combustibles (3" ceramic insulation) with smooth radius turns. Except where space constraints dictate otherwise, turns shall have 1.5 minimum radius and tapered transitions/offsets. Ductwork shall have continuously welded watertight joints and seams, with flanged end connections.
- B. Kitchen hood exhaust ductwork shall be constructed in accordance with NFPA 96 and the International Mechanical Code with external welds; maintain required duct cross-sectional area up to fan inlet, in order to preserve 1500 feet per minute minimum velocity within duct. Ductwork shall be constructed and installed to prevent the "trapping" of grease. Horizontal sections of ductwork shall slope (not less than 1/4 inch vertical per 12 inches horizontal) downward to drain toward the hood or toward an approved reservoir.
- C. For air flow measurement, provide 3/4 inch diameter threaded hex nut welded to the vertical wall of duct; position along the centerline of a straight segment of the duct, verify with Architect exact location. Provide hex head bolt with toothed lock washer to serve as plug; cut bolt flush with inside of duct.
- D. Provide an access door in each kitchen hood exhaust duct at each turn or offset and at 12'-0" maximum intervals along length of duct. Kitchen hood exhaust access doors shall be by ductwork manufacturer. Submit product data for approval. Access doors shall be (nominal

12" x 8", minimum size) stainless steel construction U.L. listed with welded stud fastener frame, insulation kit, insulation extension studs, insulation coverplate and "DO NOT OBSTRUCT" stickers. Install access doors on "vertical" sides of ductwork, not top or bottom sides, as per requirements of NFPA 96 and manufacturers installation requirements; maintain minimum elevation of opening above bottom side of duct.

- E. Kitchen hood exhaust ductwork shall be tested in accordance with International Mechanical Code (IMC) Section 506.3.5, "Grease Duct Test"; testing shall be performed prior to installation of duct insulation system. Submit test report for review.

2.06 FLEXIBLE DUCTWORK

- A. Branch run-outs shall be rectangular ducts or round rigid metal ducts insulated as hereinbefore specified. Elbows of the duct system shall not utilize flexible ductwork; use rigid round as specified above. The final 4 feet of round ducts in primary supply air system shall be factory pre-insulated round flexible ducts. The final 5 feet may be flexible duct in low pressure supply air run outs. Connect flexible ducts to rigid ducts using a separate fire rated nylon duct strap on inner lining and on outer lining. Cover all edges and seams of insulation with aluminum foil backed duct tape. Round run-out size denotes inside diameter. Pre-insulated ducts shall be Class 0 or Class 1 duct material in accordance with UL 181 and shall be UL labeled. Ducts shall have airtight coated, woven glass fiber or aluminum reinforced plastic laminate inner liner with reinforced non-peel steel ribbing. Flexible ductwork with plastic only liner is not acceptable. Pressure rating shall be equal to rating called for under "RECTANGULAR DUCTS." All jackets shall be fireproof glass fiber reinforced aluminum foil. Insulation shall be 2 inch thick fiberglass, R value of 6 minimum. Pressure drop shall not exceed 0.12 inches water gage per 100 foot run for a 12 inch diameter duct moving 500 CFM with a manufacturer's recommended positive operating pressure of 10 inches water gauge minimum. Systems connecting to primary supply ducts shall be Thermaflex M-KC, Flexmaster Type 4M, or equal as listed by addendum.
- B. For systems connecting to low pressure ducts, use Thermaflex M-KE or Flexmaster Type 1M or 8M with a manufacturer's recommended positive operating pressure of 6 inches water gauge minimum, or equal as listed by addendum.
- C. Submit all flexible ductwork for approval.

2.07 ELBOWS AND OFFSETS

- A. Provide turning vanes for elbows 30 degrees or greater in all rectangular ductwork in accordance with SMACNA Standard for single vanes. Transition panels shall not have offset angle exceeding 20 degrees unless specifically shown.

2.08 ACOUSTIC LINING

- A. For the purposes of this specification, the term "attic" refers to the cavity space between roof deck and an insulation level at the ceiling line. If all of the insulation is at the roof level, with no insulation at the ceiling line, then the cavity space is not an attic.
- B. Except where indicated otherwise on Drawings, acoustic lining in rectangular ductwork shall be glass fiber coated liner of 1 inch thickness unless otherwise noted on Drawings. Material shall meet NFPA 90A requirements and have K factor of 0.24 measured at 75°F mean temperature and have noise reduction coefficient (NRC) not less than 0.70 (per ASTM C423, Type A mounting). Duct sizes on Drawings are metal sizes, allowances having been made for

lining. Lining shall be Johns-Manville Permacote Linacoustic, CertainTeed ToughGard R, or Knauf Duct Liner E-M, submit for approval.

- C. The duct liner shall conform to the requirements of ASTM Specification C 1071 and shall not support the growth of fungus or bacteria, as per ASTM G21 and G22. Duct liner shall be installed in accordance with the latest edition of North American Insulation Manufacturer Association's *Fibrous Glass Duct Liner Standard* (NAIMA FGDLS) or Sheet Metal and Air Conditioning Contractors National Association *HVAC Duct Construction Standard, Metal & Flexible* (SMACNA HVAC DCS). Liner shall be installed with the surface treatment exposed to the air stream. Adhesive shall be applied to the sheet metal with minimum coverage of 90%. All transverse edges not receiving sheet metal nosing shall be coated. Exposed joints shall be coated with an adhesive or secured with mechanical fasteners in accordance with NAIMA Standards. All joints shall be firmly butted without gaps. All rips and tears on the air stream surface shall be repaired by coating damaged areas with approved adhesive or coating, or shall be replaced. Longitudinal corner joints may be folded and/or overlapped and compressed. Mechanical fasteners shall be used to secure the duct liner to the sheet metal, and shall be spaced in accordance with NAIMA FGDLS or SMACNA HVAC DCS (but not less than one for each two square feet of lining). These may be either impact-driven or weld-secured and shall include 1-1/2 inch diameter sheet metal washers or speed nuts. Metal nosings (either channel or zee profile) shall be securely installed over transverse line edges facing the air stream at fan discharge and any interval of lined duct preceded by unlined duct.
- D. Unless indicated otherwise on Drawings, all rectangular return air ductwork shall be lined in accordance with the above requirements. For VAV air unit systems, the rectangular low pressure supply air ductwork downstream from VAV terminal boxes (only) shall be lined in accordance with the above requirements; all other VAV system supply air ductwork shall have externally applied insulation, see SECTION 230010 - INSULATION. For constant volume air units and fan coil units, only the first 20 feet of rectangular supply air ductwork (measured along the center line of the duct main) from the discharge of the air unit shall be lined in accordance with the above requirements; other rectangular supply ductwork not to be lined shall have externally applied insulation, see SECTION 230010 - INSULATION. Refer to Drawings for additional applications requiring acoustic lining.

2.09 HANGERS AND SUPPORTING SYSTEMS

- A. Provide hangers and supports in accordance with SMACNA Standards as applicable except that straight up nails, expansion shields, etc., will not be allowed. Use auxiliary angles spanning beams where required to position duct hangers. See Drawings for additional hanger details.

2.10 DAMPERS

- A. Submittals for dampers shall include a damper schedule indicating the following for each damper:
 1. System/area served to identify each individual damper
 2. Damper model
 3. Damper nominal (duct) size
 4. Damper sleeve length, as applicable
 5. Required wall/floor opening size, as applicable
 6. Size of duct access door(s), as applicable

7. Indicate damper sleeve gauge and duct connection type (if other than rigid type connection), as applicable.
-
- B. Construct multi-blade opposed action volume dampers where called for on Drawings according to SMACNA Standards. Dampers shall be by Greenheck, Ruskin, Nailor, Pottorff, or equal as listed by addendum.
 - C. Provide automatic backdraft dampers where shown on the Drawings. Backdraft dampers shall be adjustable counterbalanced, heavy duty, pressure relief shutter type with 2 inch x 1/2 inch x 1/8 inch galvanized steel channel frames and 7 inch wide 0.063 inch thick 3003-H14 aluminum blades with 1/2 inch steel axles, self lubricating bearing and tie bar with 1/4 inch brass pivot. Damper adjustable counterweights shall be factory set to begin opening at 0.01 inch W.G. pressure differential and fully open at 0.03 inch to 0.06 inch W.G. Install dampers such that duct acoustical lining does not interfere with damper blades.
 - D. Provide fire dampers where shown on Drawings. Fire dampers shall have 1-1/2 hour or 3 hour label rating, as applicable, to meet the requirements for the fire rating of the wall/floor, and shall have 212°F fusible links, all in accordance with NFPA 90A and UL 555 (current edition). Dampers shall be per SMACNA Standards and, unless indicated otherwise, shall be galvanized steel construction. Except where indicated otherwise, fire dampers shall be dynamic type single section curtain (interlocking blade) style. Where overall damper size exceeds the listed maximum size for a single section curtain style dynamic damper, the fire damper shall be multi-blade style dynamic type. Multiple section (multi-blade) dynamic dampers shall be factory assembled/fabricated to operate as a single unit. Except where indicated otherwise, curtain style dampers shall have blades recessed "out of the air stream." For non-ducted return air transfer openings and ducted (grille to grille) return air transfer openings, dampers may be static type, single or multiple section, and may have frame style "A" with clear opening (height) of size as indicated on the Drawings. Provide fire dampers by Greenheck, Ruskin, Nailor, Pottorff, or equal as listed by addendum.
 - E. Fire dampers and combination fire/smoke dampers **shall have integral factory sleeves. Except where allowed otherwise by the Construction Documents, sleeves shall be 16 gauge minimum, except use 14 gauge where damper width exceeds 36 inches or height exceeds 24 inches**, in accordance with UL listing and SMACNA *"Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems"* for rigid duct connections. Sleeve shall be length to match wall thickness, plus width of retaining angles, duct connections and damper actuator brackets/linkage (as applicable), refer to Drawings for additional information. Damper frame shall be sealed to the sleeve. For dampers installed in primary supply air ductwork, all joints/seams of the damper sleeve shall be sealed (at the factory).
 - F. Provide combination fire/smoke dampers where shown on Drawings. Dampers shall be Ruskin Model FSD Series, Nailor 1200 Series, Greenheck FSD, Pottorff equal, or equal as listed by addendum, Leakage Class II (or Class I) fire/smoke damper (350°F temperature rating), each with 120 Volt electric motorized actuator, 70 IN-PD (minimum) torque (no "stall" type motor actuators), Belimo Model FSNF Series, Honeywell ML or H Series, Siemens GGD Series, Siebe MA Series, or equal as listed by addendum. Combination dampers shall include 212°F fusible link. Dampers and actuators shall conform to UL 555S (current edition). Dampers and actuators shall be provided by Sheet Metal Contractor. Connection of actuator will be under Division 26.
 - G. Multiblade type fire and combination fire/smoke dampers installed within supply air ductwork shall be Class I (in lieu of Class II) air foil type if damper is positioned within 10 linear feet of the discharge of the air unit.

- H. Provide UL 555S, Leakage Class I, air foil smoke dampers (350°F temperature rating) at all air units moving 15,000 CFM or more in accordance with NFPA 90A; actuator shall be same as specified for combination fire/smoke dampers. Dampers shall be by Greenheck, Ruskin, Nailor, Pottorff, or equal as listed by addendum.
- I. Provide ceiling radiation dampers where shown on drawings. Dampers shall be UL 555 (current edition) classified dampers with 212°F fusible link, insulated blades, Greenheck CRD Series, Nailor Industries Series 0700, Ruskin CFD Series, or approved equal as listed by addendum. Ceiling radiation dampers shall be rated for both steel duct and flexible duct installations (include extended sheet metal sleeve for applications with flexible ductwork connecting to top side of dampers). For applications with "lay-in" style ceiling diffusers/grilles, the damper assembly shall include all required accessories (such as "back pan" thermal blanket) and the diffuser/grille shall be style/construction to meet the requirements for the listed assembly.

2.11 FLEXIBLE CONNECTIONS

- A. Wherever ducts are to be fastened to the intake or discharge of an air moving device (including fan powered terminal units), provide a flexible connection between duct and fan. Flexible connections shall be waterproof and of fireproof fabric, at least 4 inches long (6" max.), and securely fastened with galvanized band iron hoops and mastic. Insulate flexible connections to prevent condensation.

2.12 LOUVERS – WIND-DRIVEN RAIN RATED

- A. High Velocity Wind Driven Rain Louvers – Horizontal Front Blade:
 - 1. Louvers shall be stationary high velocity wind driven rain style with Horizontal front blades and Vertical rear blades and shall have Florida Product Approval and/or Miami-Dade Notice of Acceptance to ensure a tested and qualified installation. Louver blades shall be contained within a 9-inch frame and shall be fully factory assembled. Extended sill pans shall be provided to capture and drain water to exterior of building. Louver components (heads, jambs, sill and blades) shall be factory assembled by the louver manufacturer.
 - 2. Louver performance shall be certified in accordance with the AMCA 511 Certified Ratings Program for AMCA 500-L Air Performance, Water Penetration and Wind Driven Rain and shall be licensed to bear the AMCA Seal. Free area for a size 48 in. x 48 in. louver shall not be less than 8.66 Sq. Ft. (54.1%).
 - 3. Louvers shall allow for sizes up to 60" wide x 120" high. Openings larger than the maximum section width may comprise of multiple individual louver panels without the need for additional structural reinforcing members as per the manufacturers installation instructions. Where louvers are required to be multiple sections high, adequate structural supports shall be provided in order to install the louver in accordance with the manufacturers installation instructions. **Structural supports for multi-high assemblies, if required, shall be considered as part of the building structure and not provided by the louver manufacturer.**
 - 4. Vertical mullions shall be visible for openings wider than the maximum allowable single section width. Recessed mullions for continuous blade appearance shall be provide where noted on drawings.
 - 5. Static pressure drop shall not be greater than 0.34 in. WG at 8500 cfm intake through a 48" x 48" louver.

6. **Any manufacturer that has a higher pressure drop shall be responsible for resizing the louvers to meet the specified pressure drop, or the pressure drop scheduled on drawings.**
7. Beginning point of water penetration shall not be less than 974 FPM free area intake velocity.
8. Louvers shall maintain Class A wind driven rain performance up to 863 FPM core velocity with an external wind speed of 29 MPH and an external rainfall rate of 3 in. per hour. Louvers shall maintain Class A wind driven rain performance up to 877 FPM core velocity with an external wind speed of 50 MPH and an external rainfall rate of 8 in. per hour.
9. Louvers shall comply with Florida test protocols TAS 201 (Large Missile Impact), TAS 202 (Uniform Static Air Pressure) and TAS 203 (Cyclic Wind Loading). Louvers shall be AMCA 540 Listed for Enhanced Protection Impact Resistance of Missile Level E and AMCA 550 Listed for High Velocity Wind Driven Rain. Louvers shall be capable of withstanding both positive and negative wind pressure loads up to 130 PSF when installed in accordance with the manufacturer's published installation instructions.
10. Louvers shall be Greenheck #EHV-550D, Ruskin #HZ700MD, Construction Specialties #DC-9614, Pottorff EFJ-937-MD, or equal as listed by addenda, extruded aluminum alloy shall be 6063T5 construction, or as required to meet the louvers structural requirements as follows:
 - a. Frame: 0.081 inch (minimum) wall thickness, caulking surfaces provided.
 - b. Front Blades: 0.081 inch (minimum) wall thickness, installed horizontally on approximately 4" inch centers.
 - c. Rear Blades: 0.063 inch (minimum) wall thickness, installed vertically on approximately 1.5" inch centers.
 - d. Extended Sill Pan: 0.060 inch (minimum) aluminum sheet wall thickness, with upturned side panels to help prevent water leakage.
 - e. Screen: 1/2" x .063" aluminum mesh bird screen in removable frame, mounted on interior (rear) of louver.
 - f. Finish: 70% 2-coat baked Kynar, color as selected by Architect.
 - g. Provide "blank-off" panel(s) where noted on Drawings. Panel shall consist of 1" thick mineral wool insulation sandwiched between sheet metal panels. Exterior and Interior (facing) panels shall be 0.032 inch (minimum) thickness aluminum; conceal edges of insulation with sheet metal or heavy plastic closure. Insulation shall comply with ASTM C612, with a minimum R-value of 4.2 at 75° F. Exterior side shall have a black kynar finish.

2.13 SAFE PANS

- A. Provide safe pans under air handling units (IHP, RTU, FCU, ETC.) Safe pans shall be constructed of 16 gauge Type 304 Stainless galvanized steel, with all joints lapped, riveted and soldered. Pans shall be a minimum of 4 inches deep and shall extend a minimum of 6 inches beyond all sides of the unit. Coordinate safe pan location with base supports.

2.14 ACCESS DOORS

- A. Provide access doors for service access to duct mounted cooling/heating coils, fans, filters and other locations where necessary for periodic service or inspection of mechanical equipment. Provide access doors for access to duct mounted fire and/or smoke dampers, and automatic (motorized) control dampers. Access doors for duct mounted cooling/heating coils shall be installed on air entering side of coils. Access doors shall be adequate size for easy access to the equipment/damper/coil.
- B. Access doors shall be constructed according to SMACNA Standards for 2 inch (minimum) W.G. Access doors shall be removable type with paired cam locks, two cams for doors up to 14" x 14" size and four cam locks for doors 16" x 16" to 24" x 24" size. Doors shall have foam gasketing at both the door to frame and the frame to duct matting surfaces. Access doors may be sandwich type, Ductmate Sandwich Access Door, or equal. Access doors in supply and return air ductwork shall be double wall type with fiberglass insulation sandwiched between the walls of the access panel.
- C. Access doors in primary supply ductwork shall be constructed and installed to meet the duct pressure class referred to in Section 230021.
- D. Refer to SECTION 230010 - ACCESS PANELS for access panels in ceilings and walls.

2.15 FLASHING

- A. Wherever sheet metal work under this contract passes through exposed walls or roofs, furnish and install flashings and counter-flashings necessary for weatherproofing.
- B. Make flashings and counter-flashings of sheet copper, securely soldered and fitted, except that cap flashings for ducts, hoods, etc., shall be same material as duct and isolated from dissimilar metal base flashing with roofing felt. Turn flashings out at least 10 inches.

2.16 DUCTWORK SEALING

- A. All ductwork, regardless of system pressure classification, shall be sealed in accordance with Seal Class A, as referenced in SMACNA Standards. However, refer to Section 23 0021 for additional requirements for sealing of ROUND AND FLAT OVAL DUCT AND FITTINGS. Unless indicated otherwise, all seams, both shop made and field installed, shall be sealed. Special care shall be taken to seal corners of transverse joints and grilles or diffuser tap connection to ducts.
- B. All transverse joints, fasteners, longitudinal seams and duct wall penetrations shall be sealed by applying one layer of sealant at a minimum of 20 to 30 wet mils. Sealant shall be water-based latex UL 181A-M & B-M reinforced sealant conforming to the product specifications with flame spread of 0 and smoke developed of 0. Sealer shall be rated by the manufacturer and shall be suitable for use at the system pressure classification of applicable ductwork. Basis of design sealant is Hardcast Versa-Grip™ 181.
 - 1. Shore A Hardness: >20
 - 2. Flexibility on 1/4-inch mandrel: Passes
 - 3. Time to test: Approximately 48 hours.
 - 4. Service temperature: -20 to plus 200 degrees F (minus 29 to plus 93 degrees C).
 - 5. Resistance to mold, mildew and water: Excellent
 - 6. UL 181A-M: Passes

7. UL 181B-M: Passes
 8. Surface burning characteristics: Flame spread/smoke developed rating of 25/17, tested in accordance with ASTM E 84.
 9. Seal classes: All SMACNA Classes.
 10. Pressure classes: SMACNA 1/2, 1, 2, 3, 4, 6, and 10 inches water gage.
- C. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction. Installation shall be in accordance with manufacturer's published recommendations. Before installing mastic/sealant, surface must be dry and free of dirt, oil, grease, and loose or foreign matter that could impair adhesion. Wipe ductwork to a visibly clean condition.
- D. General Application for Metallic Duct Systems:
1. Apply one-part sealant system at 20 to 30 wet mil thickness with a brush, putty knife, or caulk gun to transverse joints, fasteners, longitudinal seams, and duct wall penetrations.
 2. Tool, if necessary, caulk bead with putty knife or brush.
 3. Field check during application with a wet mil thickness gauge to check thickness.
 4. Let dry/cure per manufacturer's technical data sheet.
- E. General Application for Flexible Air Duct Systems
1. Apply one-part sealant system with a brush or spray to transverse joints, fasteners, longitudinal seams, and duct wall penetrations in accordance with manufacturer's instructions as described above in General Application on Metallic Duct Systems.
 2. Field check during application with a wet mil thickness gauge to check thickness.
 3. Let dry/cure per manufacturer's technical data sheet.

2.17 CEILING DIFFUSERS – PLAQUE TYPE

- A. Ceiling diffusers shall be aluminum constructed (except where required otherwise for fire rated ceiling applications, see below) flat face panel (plaque) type with integral backpan. Diffusers shall have a white, baked enamel finish and shall have opposed blade volume control damper, except as described under "AIR EXTRACTORS." Diffusers shall be Titus D-OMNI-AA series, Price ASPD series, Nailor AUNI series, Krueger 5PLQ or equal as listed by addendum.
- B. The frame/border style of each diffuser is to match the ceiling style for each application. The frame/border style shall be such that the diffuser face panel is installed within the range of flush with to 1/4" below the plane of the finished ceiling. For lay-in grid type ceilings, the diffuser face size is to match the grid panel size; generally a nominal 24 inch x 24 inch face size diffuser is to be provided for a 24" x 24" or 24" x 48" grid pattern, unless otherwise required. For gypsum board or plaster ceilings, provide diffuser manufacturer's matching "T-bar style plaster frame" to receive the "lay-in" style diffuser in the ceiling mounted frame.
- C. Generally the air discharge blow (throw) pattern is to be radial (4-way) horizontal pattern. Where noted on drawings to provide 1-way, 2-way, or 3-way blow pattern, provide sectionalizing quadrant blank-off panels to achieve the designated blow pattern.
- D. Where required for fire rated lay-in grid ceiling applications, diffusers shall be steel construction, U.L. Classified fire rated ceiling diffuser assemblies with fusible link damper and thermal protection blanket, see "DAMPERS."

2.18 LINEAR SLOT DIFFUSERS

- A. Unless indicated otherwise on Drawings, linear diffusers shall be Metalaire 6600 Series, Nailor 5000 Series, Titus ML Series, Price SDS Series, Krueger 1900 Series, or approved equal, with adjustable throw pattern and white finish aluminum frame. Frame style (including end border) shall match the ceiling application. For lay-in ceilings, frame style shall be similar to Price Type 14 (T-Bar lay-in) or equivalent. For gypsum board or plaster ceiling applications, frame style shall be similar to Price Type 2 (surface mount - concealed), or equivalent. Provide factory fabricated galvanized steel plenums with branch duct inlet collar and plenum, with size and edge condition to match diffuser; plenum shall be insulated in field with externally applied insulation, see "INSULATION" within this Specification.
- B. High capacity linear slot diffusers shall be Titus Flowbar High Throw Series, Nailor Flowline FLH Series, Metalaire FAL Series, Price Custom Flow Linear AS Series, or approved equal, with adjustable throw pattern and white finish aluminum frame. Frame style (including end borders) shall match the ceiling application. For lay-in ceilings, frame style shall be similar to Price Type 21/31 (expose frame, T-Bar) or equivalent. For gypsum board or plaster ceilings, frame style shall be similar to Price Type 22A (drywall concealed frame with countersink screw mounting), or equivalent; provide masking tape and/or plastic covering to protect interior surfaces of diffuser during drywall finishing scope. For applications with round branch runout ducts connecting to plenum above diffusers, plenums shall be factory fabricated galvanized steel, with size and edge condition to match diffuser; plenum shall be insulated in field with externally applied insulation, see "Insulation" within this Specification.
- C. Where linear slot diffusers are located adjacent to light fixtures, ceiling offsets or other obstructions affecting the standard plenum side inlet duct connection, provide custom height plenum to match the application and provide appropriate duct installation clearances.
- D. Submittals for linear slot diffusers shall identify each application by system/area served and the frame/border style.

2.19 SIDEWALL SUPPLY GRILLES

- A. Sidewall supply grilles shall be fully extruded aluminum constructed (except where required otherwise for fire rated walls, see "DAMPERS"), including frame, border, damper and blades, Metalaire 4004 Series, Nailor 51DV Series, Titus 272FS Series, Krueger 5880 Series, Price 22 Series, or equal as listed by addendum, double deflection grilles. Changing the horizontal and vertical deflection shall be feasible from the face of the grille. Grilles shall be prime coated, suitable for painting and shall have opposed blade volume controls, except as described under "AIR EXTRACTORS."

2.20 RETURN AND EXHAUST GRILLES

- A. Return grilles shall be 30 to 45 degree louvers, extruded aluminum constructed (except where required otherwise for fire rated walls, see "DAMPERS"), including frame, border and blades, with blade spacing 1/2 inch on centers with 1-1/4 inch frames, Titus 4FL, Metalaire H4002R45, Nailor 5155H, Krueger S585H, Price 635, or equal as listed by addendum. Exhaust grilles shall be 1/2 inch x 1/2 inch x 1/2 inch aluminum (except where required otherwise for fire rated ceiling applications, see "DAMPERS"), grid type, Titus 50F Series, Metalaire CC5 Series, Nailor 51EC Series, Krueger ECG-5 Series, Price 80 Series, or equal as listed by addendum. Frames shall be appropriate to type of ceilings in the projects. Finish

on ceiling grilles shall be white baked enamel. Finish on wall grilles shall be prime coat suitable for painting.

- B. Filter grilles shall have hinged frame to accept 1 inch thickness filter and quarter-turn screwdriver operable metal fasteners, include 30% efficiency pleated media filter(s) to match grilles.
- C. All return air grilles shall be provided with a sound attenuation device, either field fabricated or pre-manufactured, refer to detail on drawings. Pre-manufactured units shall be Price RAC Series, Titus T-RAC Series, or equal as listed by addendum.
- D. Refer to Drawings for additional requirements.

2.21 AIR EXTRACTORS

- A. Furnish and install in each rectangular duct take-off to ceiling diffusers and sidewall grilles, except the final outlet of each run, an adjustable air volume extractor and controller consisting of moving vanes on brackets. Vanes shall be capable of full closure. Controllers shall have operators accessible from grille or diffuser opening or from outside of duct. The final outlet shall have opposed blade dampers.
- B. At low pressure round duct branch take-offs, provide Flexmaster Model FLD-B03, Dace Model MSD-C03, or equal as listed by addendum, spin collar "take-off" fitting, 26 gauge (minimum) galvanized steel construction **with square rod axle, axle bushings (sleeves) and 2 inch high elevated lever (hand quadrant) regulator for externally insulated ductwork.**
- C. Air extractors shall also occur at rectangular tee branch connections. Provide an opposed blade damper at each occurrence.
- D. Submit all air extractors for approval.

2.22 VARIABLE AIR VOLUME TERMINAL UNITS (DDC)

- A. Variable air volume terminal units shall be system pressure independent variable volume units. Units shall be for single duct service with or without terminal heat as indicated on Drawings. Units shall be designed for low or medium pressure. Units shall be complete with variable volume control with control points adjustable in field. Units shall include built-in attenuation to meet sound levels scheduled. Dampers shall have linear performance characteristics with throttling capability in all positions. Units shall be minimum 24 gauge hot dipped galvanized steel with 14 gauge dampers. Construct air dampers such that when subjected to 6.0 in. W.C. inlet pressure with damper closed, total leakage does not exceed 10% of specified air flow capacity. Insulation shall be 3/4 to 1 inch thick complying with UL 181, NFPA 255 (25/50) and NFPA 90A. Units shall be double wall construction with solid galvanized steel inner liner panel enclosing the insulation to prevent air flow erosion of the insulation. In lieu of double wall, insulation may be fiber-free polymer (closed cell elastomeric) foam. Control for single duct units is as specified in Section 230060. Include fully enclosed metal cover over controller and operator. Install thread locking compound on actuator shaft set screw to prevent set screw from loosening due to vibration. Damper actuators and VAV unit controllers will be supplied to the unit manufacturer by the Temperature Controls System Contractor (see Section 230060). Units shall include factory installed fused 40 VA, 24 VAC secondary transformer and primary disconnect switch for digital controls. Refer to schedule for input voltage. The VAV unit manufacturer shall factory mount and test the motor and controls. Units shall be Trane VCEF or equal units as listed by addendum.

- B. Where terminal electric heating coils are shown, coils shall be as scheduled and as specified in SECTION 230050 - ELECTRIC AIR COILS. Electric heating coils shall be cabinet mounted or otherwise completely insulated on all sides.
- C. Provide label on each unit indicating drawing identification number, CFM range, CFM factory setting and calibration curve.

2.23 DUCT SILENCERS

- A. Duct silencers shall be as scheduled on Drawings. Silencers shall be Price RM, IAC LFM, Ruskin MLF, Vibro-Acoustics RD, Dynasonics LF Series, or equal as listed by addendum, for "straight" in-line rectangular duct applications and Price ERM, IAC ELBM, Ruskin MPELB, Vibro-Acoustics RED, Dynasonics EBS, or equal as listed by addendum, for rectangular duct elbow applications.
- B. Outer casings of the silencers shall be made of 22 gauge (minimum) type #G-90 lock former quality galvanized steel. Interior partitions shall be not less than 26 gauge (minimum) type #G-90 galvanized lock former quality perforated steel.
- C. Filler material shall be inorganic glass fiber of a proper density to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert, vermin and moisture proof. For outside air intake applications, filler material shall be totally encapsulated and sealed with a (mylar) polymer film of an approximate thickness of 1.5 mils; the encapsulated fill material shall be separated from the perforated baffles by means of a non-combustible, erosion resistant, acoustic stand-off.
- D. Combustion ratings for the acoustic fill, encapsulation film, and the acoustic stand off shall be not greater than the following when tested in accordance with ASTM E-84, NFPA Standard 255 or UL No. 723:
 - 1. Flamespread Classification: 20
 - 2. Smoke Development Rating: 20
- E. Units shall be constructed in accordance with the ASHRAE Guide recommendations for high pressure duct work. Seams shall be lock formed and mastic filled.
- F. Silencer ratings shall be determined in a duct-to-reverbent room test facility which provides for airflow in both directions through the test silencer in accordance with ASTM Specification E 477. The test facility shall be NVLAP accredited for the ASTM E 477 test standard. Data from a non-accredited laboratory will not be acceptable. The test setup and procedure shall eliminate all effects due to end reflection, directivity, flanking transmission, standing waves and test chamber sound absorption.
- G. Acoustic ratings shall include Dynamic Insertion Loss (DIL) and Self-Noise (SN) Power Levels both for forward flow (air and noise in the same direction) and reverse flow (air and noise in opposite directions). Data shall be for test silencers no smaller than the following cross sections:
 - 1. Rectangular, in: 24 x 24, 24 x 30 or 24 x 36.

- H. Static pressure loss shall not exceed the values indicated on the Drawings or in no case, exceed 0.1 in. w.g. at the rated and scheduled CFM. Air flow measurements shall be made in accordance with ASTM Specification E 477 and applicable portions of ASME, AMCA and ADC air flow test codes. Airflow velocities shall not exceed 1,000 FPM. Manufacturers unable to maintain the required pressure drop and air velocity shall increase silencer dimensions as required to meet these requirements. Adjustments shall be the Contractor's responsibility.
- I. With submittals, the manufacturer shall supply certified test data on Dynamic Insertion Loss, Self-Noise Power Levels and Aerodynamic Performance for Reverse and Forward flow test conditions. Test data shall be for a standard product including all the performance effects caused by the encapsulation film and acoustic stand-off materials. Do not attempt to match this data with the catalog ratings for conventional unprotected silencers. All rating tests shall be conducted in the same facility, shall utilize the same silencer, and shall be open to inspection upon request from the Architect/Engineer.

PART 3 - EXECUTION

3.01 OBSTRUCTIONS

- A. Make allowances for beams, pipes, and other obstructions in the construction of the building and for work of other contractors whether or not these are shown on Drawings.
- B. Coordinate duct layout and VAV terminal unit placement with ceiling construction, light fixtures, and other ceiling mounted devices for placement of equipment for ease of servicing.
- C. Transform, divide or offset ducts as required, in such a manner as to maintain the same cross-sectional area of duct as indicated on Drawings. Where it is necessary to take pipes or similar obstructions into ducts, the ducts need not be enlarged if the decrease in area does not exceed 10% and such decrease is approved in writing by the Architect. If the decrease in area would exceed 10%, enlarge the duct to maintain duct area not less than 90% of that indicated on Drawings. In either case, provide a streamlined easement or collar of approved design. Contractor shall not fabricate ductwork before routing at obstructions is resolved. See "COORDINATION OF TRADES."

END OF SECTION

SECTION 230021 - ROUND AND FLAT OVAL DUCT AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and erect in a neat, workmanlike manner all ducts and sheet metal work shown on Drawings. Verify all dimensions at the site, making all field measurements and shop drawings necessary before fabrication and erection of sheet metal work. Report any deviations to the Architect and obtain instructions before any ductwork is fabricated. Obtain approval of the Architect on all deviations from the contract Drawings and Specifications, as may be necessitated by job conditions otherwise.
- B. Provide **factory** fabricated round and flat oval ductwork and fittings as per this Specification where shown on Drawings. For all primary systems, see Section 230020. Refer to drawings for sizes and configurations.

1.02 DEFINITIONS

- A. Basic Round Diameter: The diameter of the size of round duct that has a circumference equal to the perimeter of a given size of flat oval duct.
- B. Critical Path or Design Leg: The duct circuit that requires maximum pressure (design pressure) to deliver the design CFM.
- C. Downstream: The direction to which air is flowing.
- D. Excess Pressure: The additional pressure, above what is needed, to operate a path from the fan to a terminal. Excess pressure will cause additional airflow to the path if it is not dampered.
- E. Exhaust/Return Air Duct or System: An air handling system or a portion of a system that operates under negative pressure relative to atmosphere.
- F. Flat Span: The flat oval duct dimension determined by subtracting the minor (smaller) axis from the major (larger) axis.
- G. Gored Elbow: A segmented elbow of any bend angle where each segment (gore) is joined at an angle less than 45°. See "Mitered Elbow."
- H. Loss Coefficient: A measure of fitting performance defined as the total pressure loss of a flow path of a fitting divided by a reference velocity pressure.
- I. Mitered Elbow: A two-piece 90° (bend angle) elbow with segments joined at a 45° angle relative to either end. See "Gored Elbow."
- J. Pressure/Velocity Classifications: A means of designating duct systems as high, medium, and low pressure or velocity.
- K. Supply Duct or System: An air handling system or a portion of a system that operates under positive pressure relative to atmosphere.
- L. Upstream: The direction from which air is flowing.

1.03 REFERENCES

- A. The following references are referred to in the Specification below by the appropriate number:
 - 1. *Fundamentals Handbook*, (latest edition), American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
 - 2. *HVAC Systems and Equipment Handbook*, (latest edition), ASHRAE.
 - 3. *HVAC Duct Construction Standards*, (latest edition), Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
 - 4. *HVAC System Duct Design*, (latest edition), SMACNA.

1.04 QUALIFICATIONS

- A. All duct and fittings shall be manufactured by a company for whom the manufacture of spiral duct and welded fittings has been a principal business for at least 10 years.
- B. All duct and fittings covered by this Specification shall be manufactured by a single company.

1.05 SUBMITTALS

- A. **Provide sheet metal floor plans of ductwork covered in this section, drawn to the same scale as the Contract Drawings. Use Contract Drawing sheet size. Show on each floor plan the building walls, floor penetrations, fire dampers, access doors, ducts with sizes and bottom elevations, terminal types and air quantities.**
- B. **For submittals of other ductwork not covered under this section, refer to Section 230020, as applicable.**

1.06 MARKING AND STORAGE

- A. Mark each section of ductwork to be delivered to the project with a unique section number, as indicated on the shop drawings. Use EHG ductcap reusable weatherproof elastic material that conforms to the shape of the duct. This covering shall be applied at the shop/factory before shipment to the job site. Store ductwork in a clean and dry environment with all open ends sealed, see paragraph 1.1.B in SECTION 230020, regarding duct cleanliness.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Unless otherwise specified, all duct and fittings shall be a minimum G-90 galvanized sheet metal in accordance with ASTM A653, A653M, A924 and A924M Specifications.
- B. All duct materials, sealants and adhesives directly exposed to airflow shall be noncombustible and conform to requirements of NFPA 90A.
 - 1. Supply Duct:
 - a. Except where indicated otherwise, all primary supply duct shall be of round spiral lockseam construction except where diameters exceed 84 inches or where space limitations prevent the use of round duct. In addition, low pressure round supply duct may be round spiral lockseam construction.

Longitudinal seam duct shall be used in those sizes greater than 84 inches in diameter for which spiral duct is unavailable. Steel round duct shall be of standard spiral construction (without intermediate ribs) and shall be provided according to Table A.

TABLE A - ROUND SUPPLY DUCT CONSTRUCTION

Diameter (inches)	<u>Standard Spiral Gauge (Supply Duct)</u>	
	<u>0-2 inches wg</u>	<u>2-10 inches wg</u>
3- 8	28	26
9-14	28	26
15-26	26	24
27-36	24	22
37-42	22	20
44-50	22	20
52-60	20	18
62-84	18	18

- b. Standard spiral gauges shown in Table A are in accordance with Reference 3 for round steel supply duct. The use of round spiral duct for the pressures listed in Table A shall be limited to systems whose maximum operating pressure never exceeds 2 inch wg for low pressure systems and 10 inch wg for high pressure systems. For purposes of gauge selection, duct and fittings downstream of VAV boxes may be considered a separate system, refer to Section 230020.
- c. Where space limitations prevent the use of round duct, supply duct shall be of flat oval, standard spiral (without intermediate ribs) or longitudinal seam construction, according to the gauges given in Table B.

TABLE B - FLAT OVAL SUPPLY DUCT CONSTRUCTION

Major Axis Dimension (inches)	Standard Spiral Gauge (supply duct)	Longitudinal Seam Gauge (supply duct)
to 24	24	20
24-36	22	20
37-48	22	18
49-60	20	18
61-70	20	16
71 and greater	18	16

- d. Gauges shown in Table B are in accordance with Reference 3 for flat oval supply duct. Flat oval duct shall be reinforced based on its flat span dimension and maximum operating pressure. Reinforcement requirements shall be in accordance with Reference 3.

2. Exhaust Duct and Return Air Duct:

- a. Except where indicated otherwise on Drawings, all duct subject to negative pressure shall be of round spiral lockseam construction, within the range of available spiral sizes, for the required gauge where space limitations prevent use of round duct, exhaust and return air duct shall be flat oval construction. Duct gauge and reinforcement requirements shall depend on diameter, maximum operating pressure, and the air being conveyed. Applicable gauge and reinforcement requirements shall be in accordance

with References 1 through 4 for negative 2 inch WG pressure. **Submit data confirming gauge and reinforcement required for flat oval construction at the design negative pressure and flat span dimension of the ductwork to be provided.**

3. Duct Lengths:

- a. Round and flat oval duct shall be provided in continuous, unjoined lengths wherever possible. Except when interrupted by fittings, round spiral duct sections shall not be less than 12 feet long. Flat oval duct not interrupted by fittings shall not be less than 12 feet long except when manufacturing limits the length to 6 feet maximum.

4. Double Wall Ducts:

- a. Double-wall (insulated) duct shall be provided where specified on Drawings or Contract Documents. Unless otherwise indicated, all insulated duct diameters shown on Drawings are nominal inner liner dimensions.
- b. The first 20 linear feet of flat oval supply air ductwork from the discharge of VAV air units shall be double wall ductwork; where double wall ductwork shown on Drawings exceeds 20 feet minimum length, provide length as shown. The 20 linear feet criteria shall be measured along the center line of the ductwork and shall include any section of branch ductwork within the 20 linear feet cumulative measurement.
- c. Insulated duct shall be constructed of a perforated inner liner, a 1 inch layer of fiberglass insulation, and an outer pressure shell. For 1 inch insulation, the outer pressure shell must be 2 inches larger than the (nominal) inner liner dimension. Outer shell gauge shall always be based on actual outer shell dimensions.
- d. Round and flat oval liners shall be constructed according to Table C. For flat oval products, the diameter shown in this table is the basic round diameter.

TABLE C - INSULATED SUPPLY DUCT CONSTRUCTION

Inner Liner <u>Diameter (inches)</u>	Standard	
	<u>Spiral Gauge</u>	<u>Longitudinal Seam Gauge</u>
3 - 8	24	24
9 - 36	24	24
37 - 60	26	22
61 and Up	22	20

- e. When perforated liner is indicated, the acoustical performance shall equal or exceed that shown in Reference 1.2.17. Perforations in the liner walls shall be 3/32 inch in diameter with an overall open area of 23%.
- f. All insulated duct shall have a maximum thermal conductivity (k) of 0.27 Btu/hr/sq ft/°F/inch thickness at 75°F mean temperature.
- g. Insulation ends shall be provided at all locations where internally insulated duct connects to single-wall duct or to any non-insulated component. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.

5. Fittings

- a. Except where indicated otherwise on Drawings, primary supply system and exhaust/return air system fittings shall be round or flat oval as determined by the duct configuration. Exhaust and return air system fittings shall have a wall thickness two gauge number (one even gauge number) heavier than the lightest allowable gauge of the downstream section of duct to which they are connected, in accordance with that for (straight) exhaust and return air duct. Round steel supply fittings that are not elbows shall have a wall thickness in accordance with Table D.

TABLE D - SUPPLY AIR (NOT ELLS) FITTING CONSTRUCTION

Fitting Body Diameter (inches)	Minimum Round Supply Fitting Gauge	
	0-2 inches wg	2-10 inches wg
3-14	26	24
15-26	24	22
27-36	22	20
37-50	20	20
52-60	18	18
62-84	16	16

- b. Gauges shown in Table D are in accordance with Reference 3, Pages 3-2, 3-3 for round steel supply duct. The use of round fittings for the pressures listed in Table D shall be limited to systems where maximum operating pressure never exceeds 2 inch wg for low pressure systems and 10 inch wg for high pressure systems. For purposes of gauge selection, round supply duct and fittings downstream of VAV terminal boxes shall be considered as low pressure system and may be as specified in this section of the Specifications.
- c. Flat oval supply fittings shall be constructed in the same gauges as longitudinal seam flat oval duct, in accordance with Reference 3 (see also Table B).
- d. Unless otherwise specified, joints shall be solid welded. All welded joints on galvanized fittings shall be coated with a protective paint, inside and out, to prevent damage to the galvanized surface.
- e. Elbows shall be of die-stamped, gored, pleated, or mitered construction. The bend radius of stamped, gored, and pleated elbows shall be 1.5 times the elbow diameter. Unless elbow construction type is specified on Drawings or Contract Documents, the following requirements will apply. All round 90° elbows, all round 30°, 45° and 60° elbows, and all flat oval elbows shall be of gored construction except where space restrictions require a mitered elbow. Round elbows in diameters of 10 inches or less may be of die-stamped 20 gauge construction (45° and 90° only) or pleated 26 gauge construction (30°, 45°, 60° and 90° only) except where space restrictions require a mitered elbow. Mitered elbows shall be used only where space restrictions do not permit the use of 1.5 bend radius elbows. Mitered elbows shall always be supplied with single-thickness turning vanes. Flat oval mitered elbows shall be solid welded.
- f. Diverging-flow (supply)/converging-flow (exhaust and return air) fittings shall be constructed with a radiused entrance to all branch taps and with no excess material projecting from the body into the branch tap entrance. **All takeoff or branch entrances shall be by means of factory-fabricated fittings.** Factory-fabricated duct/saddle tap assemblies with a 2 inch minimum width duct connection flange (at tap connection to duct) may be used for single wall branch and take off fittings. Unless required otherwise

due to space restrictions, take off and branch entrances shall be 45° entry, conical tee or low loss tee. Straight tee entrances may be used for return air systems at grille connections.

- g. Double-wall (insulated) fittings shall be provided where specified on Drawings or Contract Documents. Insulated fittings shall be constructed of a perforated inner liner, a 1-inch layer of fiberglass insulation, and an outer pressure shell. For 1-inch insulation, the outer pressure shell will be 2 inches larger than the (nominal) inner liner dimension. For supply ducts, outer shell gauge and construction shall always be based on actual outer shell dimensions. For exhaust and return air ducts, outer shell shall be two gauge numbers (one even gauge number) heavier than the lightest allowable gauge of the downstream section of duct to which connected, in accordance with that for exhaust and return air ducts.
- h. **All take off or branch fittings in double wall duct shall be by means of factory-fabricated fittings. All diffusers, grilles directly from the double wall duct shall be internally lined.**
- i. Round and flat oval liners shall be constructed according to Table E. For flat oval products, the diameter shown in this table is the basic round diameter.

TABLE E - ROUND AND FLAT OVAL INNER LINER CONSTRUCTION

Inner Liner <u>Diameter (inches)</u>	Gauge <u>Minimum</u>
3-34	24
35-58	22
60-88	20

- j. All insulated fittings shall have a maximum thermal conductivity (k) of 0.27 Btu/hr/sq ft/°F/inch thickness at 75°F mean temperature.
- k. When perforated liner is indicated, perforations in the liner walls shall be 3/32 inch in diameter with an overall open area of 23%. Submit performance data.

2.02 ACCESS DOORS

- A. Access doors shall be provided immediately downstream of all fire and/or smoke dampers and elsewhere as indicated on Drawings. Doors shall be constructed and installed in accordance with SMACNA Standards to suit the pressure classification and the location/duct configuration to be installed.
- B. All access doors used for resetting dampers, cleaning filters, or performing general maintenance inside duct systems shall be standard bolted construction.
- C. In supply duct systems, a relief-type access door shall be provided immediately upstream of all smoke and fire dampers (or other dampers subject to sudden closure) when there is no branch takeoff near that location or when the branch takeoff is not sufficient to relieve the positive pressure if a damper closes suddenly. Relief-type doors shall be fastened by spring clips that release if sudden positive pressure occurs, for example when a damper closes suddenly. The door shall be provided with a pressure-seal gasket and shall open with the positive pressure. A safety chain shall be attached to the door so that it will not travel downstream if activated by positive pressure. Ductwork with 1 inch, 2 inch, or 3 inch thick insulation shall use insulated frame and steel insulated doors.

2.03 VOLUME DAMPERS

- A. All manual volume dampers shall be as applicable to match the type duct system and shall be constructed to slip-fit into or between adjoining duct sections. Flat oval volume dampers shall be constructed with steel blades, stiffened as required, and bronze or stainless steel bearing sleeves pressed into the frame for single wall ducts or the outer shell for double wall ducts to support the damper axles. The axle shall extend 6 inches from the frame body. For flat oval ducts, a center mullion shall be provided for dampers with nominal major axes exceeding 36 inches. Unless indicated otherwise, provide manual lever operator, locking quadrant with wing nut, for each damper.
- B. Provide an insulation stand-off bracket at the shaft operator end to receive 2 inch external insulation.
- C. Unless otherwise specified, all fittings shall be constructed in accordance with Reference 1 - 4.

2.04 JOINT CONSTRUCTION

- A. On exhaust and return air duct systems, the requirement for flanged joints or slip coupling joints depends upon the diameter/configuration and maximum operating pressure. All round supply system sections and round exhaust/return air system sections which do not require flanged connections in diameters of less than 36 inches shall be provided with slip couplings.
 - 1. All fitting ends shall be sized to slip inside mating duct sections. They shall provide a tight fit and have a minimum 2 inch insertion length with a stop bead. No additional coupling shall be required for duct-to-fitting joints.
 - 2. Duct-to-duct joints shall be by means of a slip coupling that fits inside both mating duct sections (fitting size). Couplings shall provide a tight fit and have a minimum 2 inch insertion length with a stop bead.
 - 3. Fitting-to-fitting joints shall be by means of a slip coupling that slips over both mating fitting ends (duct size). Couplings shall provide a tight fit and have a minimum 2 inch overlap length.
- B. All round duct system sections with diameters greater than 36 inches shall be provided with flanged joints. (Note, exhaust/return air duct systems may require flanged joints at diameter less than 36 inches, depending on maximum operating pressure.)
 - 1. Welded flanges shall be solid welded or tack welded and bonded with a UL classified cement. The finished flange assembly must be able to withstand maximum design pressure with no leakage.
 - 2. Welded and bolted flanges on spiral duct shall include a fully welded sleeve that fits inside the end of the duct and provides a flange that will retain the angle ring on the duct. On fittings, the retaining flange may be a turn-out of the fitting body.
 - 3. Roll formed flanges on duct and fittings shall be tack welded and include an integral mastic sealant.
- C. All system sections with double-wall (insulated) duct shall be provided with both an inner liner coupling and an outer pressure shell coupling.
 - 1. Outer shell connections shall be made with slip couplings if the outer shell diameter is less than 36 inches for round duct and if the outer shell major axis is less than 42 inches for flat oval. Outer shell connections shall be made with flanged joints if the outer shell diameter is 36 inches or greater for round duct and if the outer shell major

- axis 42 inches or greater for flat oval duct. Note, exhaust/return air duct systems may require flanged joints at diameters less than 36 inches, depending on maximum operating pressure.
2. When an outer shell connection is by slip coupling, a separate slip coupling shall be used to connect the inner liner at duct-to-duct joints.
 3. When reinforcement is required, all sections shall be provided with flanged joints or slip channel couplings. Flanged connections shall be sized so that they will also satisfy the requirement for reinforcement at the flange connections. Slip-channel couplings shall be a combined slip joint, trapeze hanger with channel reinforcement. When properly selected for duct size and operating pressure, these couplings are acceptable for all joint applications.
 4. When an outer shell connection is by flanged joint, a separate slip coupling shall be used to connect the inner liner sections at duct-to-duct joints.
 5. All fitting liners shall extend 1 inch beyond the outer shell cut-off if the inner liner diameter is 7 inches or less, and 2 inches beyond the outer shell cut-off if the inner liner diameter is greater than 7 inches, to provide an inner liner coupling at duct-to-fitting joints.
 6. To allow expansion of the inner liner due to changes in temperature, inner liner couplings in duct and fittings shall not be mechanically fixed or sealed.
- D. All flat oval system sections shall be provided with connectors of a type determined by the need for reinforcement. Ductwork shall be reinforced as per SMACNA Standards (see "REFERENCES" No. 3) for 6 inch water gauge pressure class. Where reinforcement is not factory supplied with the flat oval ductwork, **the Contractor shall provide to meet this pressure class.**
1. When no reinforcement is required, all flat oval sections with a major axis dimension less than 42 inches may be joined with slip couplings, slip-channel couplings, or roll formed flanges.
 2. When no reinforcement is required, all flat oval sections with a major axis dimension equal to or greater than 42 inches shall be provided with flanged joints or slip channel couplings.
 3. When reinforcement is required, all flat oval sections shall be joined with flanged connections or slip-channel couplings. Flanged connections shall be sized such that they will also satisfy the requirement for reinforcement at the joint location. Slip-channel couplings shall be a combined slip joint, trapeze hanger with channel reinforcement. When properly selected for duct size and operating pressure, these couplings are acceptable for all flat oval duct joining applications.

PART 3 - EXECUTION

3.01 GENERAL

- A. All round and flat oval duct and fittings shall be installed in accordance with Reference 4 and manufacturer's requirements.
- B. Transverse joints and longitudinal seams shall be sealed with a duct sealant of the type specified hereinafter. Spiral lockseams are not longitudinal seams and do not require duct sealant.
- C. Assembly joints to be installed indoors shall be sealed with a water-based duct sealant that is formulated to withstand temperatures from -20 to +150°F. Sealant shall be formulated

such that surface preparation is not necessary. Sealant shall be UL Classification. Sealant shall be United McGill Uni-Grip, Hardcast Iron Grip or approved equal.

- D. Flanged joints in indoor applications shall be sealed with a duct sealant that has a synthetic elastomer base and is formulated to withstand temperatures from -20 to +150°F. Sealant shall be formulated such that surface preparation or solvent cleaning is not necessary. Sealant shall have a UL Classification marking with a flame spread of 5 and smoke developed of 5 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 5 when applied to inorganic reinforced cement board, both at a coverage of 80 square feet per gallon. Sealant shall exceed 500 hours without becoming brittle under ASTM D572 test conditions (oxygen bomb).
- E. Where duct liner adhesive is used to secure insulation to metal surfaces, it shall have a UL Classification marking with a flame spread of 0 and smoke developed of 0 when applied to 18-gauge galvanized steel.
- F. Duct hangers shall be provided in accordance with References 3 and 4.

3.02 DUCT SYSTEM PERFORMANCE

- A. Duct system shall be constructed and installed to maintain minimum friction loss throughout. The fewest possible number of duct joints shall be used. Couplings shall be tight to the duct wall surface, and projections into the duct at connections shall be minimized. The inside surface of all duct (area exposed to airflow) shall always be constructed of sheet metal.
- B. The system shall be designed for optimum performance. Any subsequent alterations to the design must be accompanied by a computer analysis or calculations showing that the proposed alterations will still provide the original design volume without increasing the system total pressure.
- C. Any unavoidable field changes to the original design (offsets, etc.) must be reported to the Architect so that accurate "as built" operating parameters may be established.

END OF SECTION

SECTION 230030 - HVAC PIPING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install in a neat, workmanlike manner all piping shown on Drawings or that is specified or required to provide a complete, properly operating installation.
- B. Where pipe or equipment shall be insulated, extend all grease and oiling fittings from equipment to locations outside of insulation and provide rigid supports.
- C. The Contractor shall provide small ready fire extinguisher at all welding and cutting operations indoors.
- D. All building services piping defined by ASME B31.9 (including, but not limited to chilled water, heating water, condenser water, steam, compressed air and vacuum piping) shall comply with the current edition of ASME B31.9 "Building Services Piping" for materials, products, fabrication, installation and testing of piping systems.

1.02 SERVICE CONNECTIONS

- A. All connections to services shall be verified by the Contractor. Where costs for service connections are incurred, the Contractor shall include these costs in his bid.

1.03 TESTING

- A. Test all piping and prove tight to the satisfaction of the Architect before any covering/insulation is applied, or trenches backfilled.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide materials necessary to accomplish the installation of the piping systems.

PART 3 - EXECUTION

3.01 PIPE JOINTS

- A. Threaded joints shall be American Standard taper pipe threads made up metal-to-metal with a thread lubricant. No hard setting pipe thread cement or caulking will be allowed. Cut threads so that a maximum of three threads remain exposed after the fitting is made up. Ream all pipe ends after cutting and clean before erection.
- B. Make up copper piping joints with soldered joints using sweat type fittings. Cut pipe square and remove all burrs before assembly. Carefully clean and solder pipe and fittings with solder containing 95% tin and 5% antimony using non-corrosive flux. Solder or fluxes used shall not contain lead or lead compounds. The Contractor may, at his option, braze joints in copper piping using silver solder, phos-copper, silphos, or other high temperature brazing alloy approved by the Architect. Solder used for potable water systems shall be lead free.

- C. Make plastic pipe and pipe fitting joints as per the requirements of the manufacturer using joining methods and materials in strict accordance with all applicable standards. Generally, make joints using proper materials, properly prepared and complying with all required procedures and techniques regarding cleanliness, dryness, temperature, physical alignment and all other pertinent precautions. Gasketed joints shall have beveling at spigot ends and shall be cleaned then lubricated (as per manufacturer's instructions) prior to inserting ends.

- D. In addition, follow all required procedures for solvent welded joints including but not limited to the following.
 - 1. Cut the pipe square and properly deburr and bevel.
 - 2. Follow all manufacturer's requirements providing the separate steps of cleaning, priming and cementing.
 - 3. Use purple primer so that use can be clearly observed.
 - 4. Use an appropriate number of workers for required procedures and timing.

- E. Refrigerant piping shall be brazed using brazing rods consisting of 6% to 15% silver alloy. Do not use soft solder or lead-based solder. Joints shall be heated to proper brazing temperature being sure that it is uniformly hot so brazing material will flow to all parts of the joint. During brazing, the pipe and fittings must be kept full of nitrogen to prevent formation of scale.

- F. Welded Joints/Procedures:
 - 1. Make welded joints by the metallic arc or gas welding process in accordance with current version of American Welding Society (AWS) D10.12M/D10.12. Welding electrodes shall have coating and diameter as required by the manufacturer for the type and thickness of work being done.
 - 2. The preferred method of field cutting piping shall be with a band saw or abrasive wheel with the cut edge perpendicular to the length of the pipe. Pipe cuts using hand torch methods may be utilized provided the torch cutting process occurs at a location exterior of the finished building, the rough edges of the torch cut pipe is prepared for welding by field grinding and the root opening tolerances of the weld joint is maintained.
 - 3. All pipe ends for welding shall be beveled. Machine beveling in shop is preferred. Field beveling may be done by flame cutting or grinding to recognized standards; however flame cutting shall occur at the exterior of the finished building. The bevel angle shall be uniform and shall be approximately 37° leaving a 1/8" high face at the inside edge of the pipe.
 - 4. Pipe sections to be welded shall be aligned such that the surfaces to be joined are parallel to each other, and the groove to be welded is uniform and approximately 75° wide. The root of the pipe shall be separated no more than 1/8".
 - 5. The root shall be welded in a single pass with the rod perpendicular to the center line of the pipe.
 - 6. The groove remainder shall have a series of fill welds to cover the height of the groove. Each fill weld shall be a single pass and shall be repeated until the groove is filled.
 - 7. The final weld shall be a corner weld, single pass covering the full width of the welded joint.
 - 8. All welds shall be uniform in width and depth and free of cracks, holes, sputter points, cold laps and points and gouges in the pipe wall.
 - 9. All fittings in welded piping shall be factory-fabricated seamless welding fittings conforming to ANSI B16.9 and constructed of the same material and weight (or

schedule) as the piping attached. Where the size of a branch take-off does not exceed 2/3 of the diameter of the main to which connected and the main is 2-1/2" diameter or larger, branch take-offs may be made with factory fabricated "O-LET" fittings, to match the class of fabrication.

10. Welds found not complying with the above methods or otherwise appear to employ poor workmanship shall be selected by the Architect for X-ray analysis with the cost borne by the Contractor. Unsuitable welds shall be removed and, using new pipe, remade.

3.02 SLEEVES AND PLATES

- A. Wherever pipes pass through concrete or masonry walls or structural slabs, furnish and install sleeves, properly located for the work. Where pipes pass through monolithic concrete floors, omit sleeves and use double wrap of 15 pound tarred felt.
- B. Sleeves shall be of sufficient size to allow the specified pipe covering to pass through the sleeves. Finish flush with floors where exposed to view in finished areas of the building, 2 inches above floors where in equipment rooms and furred spaces and 6 inches above roofs. Seal all spaces between sleeves and pipes or pipe coverings. Use method as described under "OPENINGS, CUTTING AND PATCHING" or ceramic fiber packing or a mechanical device for fire rating to match wall or floor.

3.03 ESCUTCHEONS

- A. Where pipes passing through walls, floors and ceilings are exposed to view in finished areas of the building, provide nickel plated pressed steel split floor and ceiling plates which shall cover the opening and fit snugly to the pipe or covering.

3.04 ACCESS PANELS

- A. Provide access panels in ceilings and walls where required for access to valves and other devices. Access panels shall be as specified under "BASIC MATERIALS AND METHODS." Where lay-in ceilings exist, no access panels are required.

3.05 PIPE SUPPORTS

- A. Support pipe carrying cold fluids in hangers which allow the pipe covering to pass full thickness through the hanger. Install metal saddles as specified under "INSULATION" to protect the covering.
- B. In general, suspend horizontal runs of pipe from the overhead construction using steel clevis type, band type or split ring malleable iron hangers, suitable for the pipe size and weight. Anchor hanger rods to building construction using beam clamps, inserts, weld clips, drilled bolts and nuts, etc. Any straight up nails, wood bolts or concrete expansion shields will not be allowed. Verify final exact hanging arrangement with the Architect. See Drawings for additional support information. Size rods as follows:

<u>Pipe Size, Inches</u>	<u>Rod Diameter, Inches</u>
2 and Smaller	3/8
2-1/2 and 3	1/2
4	5/8
6 - 8	3/4
10 - 12	7/8
14 - 18	1

- C. Where two or more pipes run parallel and at the same location, they may be supported on channel or angle iron trapeze hangers, suspended from the overhead construction by rods same as specified for single hung pipe, except that the hanger rods shall be increased in size to support the additional weight. Thread lower ends of hanger rods 2 inches for adjustment and provide with nuts at top and bottom of channels. Upon completion of work, cut the rods off to present a neat appearance.
- D. For hangers supporting bare (unprotected) copper piping, provide factory manufactured hanger ring/clamp with integral isolation material to minimize noise transfer and damage from abrasion. The isolation material shall be designed specifically for the application and shall be met ASTM E-84 25/50 flame/smoke rating for plenum environment.
- E. Unless otherwise specified herein or on Drawings, space hangers for steel pipe at not more than 5 feet for pipe 1 inch and smaller and at not more than 10 feet for pipe 1-1/4 inches and larger. Support copper tubing at intervals not exceeding 8 feet. Support plastic pipe at intervals one third closer than for steel pipe.
- F. Provide supports and anchors for all pipe in horizontal or vertical position as required for installation satisfactory to Architect.

3.06 PIPE FLASHINGS

- A. Where pipes extend through roof or exterior walls, use flashings as required for weatherproofing. Roof flashings shall be lead with minimum 10 inch turnout and rolled into top of pipe. Wall flashings may consist of suitable caulking.
- B. For metal panel roofing systems, flashings shall be T.W. Buildex Dek Tite, The Pate Co. Pipe Flashing Device, or equal, conical shaped, long life E.P.D.M. rubber stepped boot assembly with flexible aluminum base ring. For conforming to contour of metal roofing panel, provide required sealant caulking, self-sealing fasteners and accessories necessary for installation in accordance with manufacturer's requirement to insure a weather-tight/rain-tight installation.

3.07 PIPING INSTALLATION

- A. Run piping parallel with lines of the building, unless specified or noted otherwise. All pipe shall have minimum one-half inch clearance from other work, including coverings.
- B. Install piping so as to eliminate air pockets and permit complete drainage, providing air vents at all high points and drains at all low points. Install piping so that it can expand or contract freely. Pipe all air vents to drain.
- C. Install drains at low points in mains and risers consisting of tee fitting, 3/4 inch ball valve and short 3/4 inch threaded nipple and cap.

- D. Grade horizontal drain piping downward in the direction of flow at least 1/4 inch per foot wherever possible but in no case less than 1/8 inch per foot.
- E. Make all changes in direction by the appropriate use of long radius fittings. Where it becomes necessary because of space conditions to use short radius fittings in any other location, obtain the consent of the Architect before they are installed.
- F. After connection of refrigerant piping between indoor/outdoor units, charge system with proper refrigerant to 150 pig (minimum) and check each sweat joint with liquid (soap solution) leak detector and an electronic leak detector. If a joint leaks, cut it out and start over. Do not lay another layer of brazing; do not exhaust refrigerant, recover and reprocess. Evacuate refrigerant system to a vacuum of 500 microns, then break this vacuum with dry nitrogen and evacuate system again, re-establish 500 microns. Where manufacturer's requirements exceed the above requirements, follow manufacturer's requirements. Fill refrigerant system with proper amount of final refrigerant, test system and adjust charge level as per manufacturer's requirements.

END OF SECTION

SECTION 230040 - HVAC PIPING MATERIALS

PART 1 - GENERAL

1.01 SCOPE

- A. Piping within air ducts, plenums or other similar compartments used as part of an air distribution system shall be non-combustible or have a flame spread of not over 25, and shall have a smoke developed rating no higher than 50; no plastic piping is allowed in such spaces unless specifically rated for such service.
- B. All steel pipe shall be in accordance with the "American Standards for Wrought Steel Pipe." Piping materials shall be in accordance with the following.

PART 2 - PRODUCTS

2.01 EQUIPMENT DRAIN PIPING

- A. Condensate drains from evaporators shall be Type "L" hard copper with wrought copper fittings. Drains shall be 1-1/2 inch minimum size. Where drains are not in air plenums, material may be Schedule 40 PVC plastic pipe and fittings; see "SCOPE" in "PART 1" of this section of the Specifications. Drains from other equipment and piping system points shall be Schedule 40 galvanized steel.

2.02 REFRIGERANT PIPING

- A. Refrigerant piping shall be "ACR" type copper tubing, with long radius elbows and bends.

2.03 FITTINGS

- A. Screwed fittings shall be fine grain full weight malleable cast iron as specified, with smooth cut tapered threads. Welding fittings shall be seamless steel full standard weight. Mitered ells or notched tees will not be allowed. Where pipe 2 inches and smaller tees into pipe 2-1/2 inches and larger, threaded or welded saddle fittings may be used for tees where the branch size is not more than one-half the main size.
- B. Companion Flanges 2-1/2 inches and larger shall be 150 pound forged steel slip-on or welding neck type with raised face. Companion flanges 2 inches and smaller shall be standard 125 pound cast iron, screwed pattern. Flange bolts and nuts shall conform with ASTM A307, Grade B. Gaskets shall be suitable for the service intended.
- C. PVC pipe threaded connections larger than 1 inch shall be male threaded fittings; not female thread. When connecting PVC piping to metallic piping or fittings, Contractor shall use plastic male thread into a metallic female thread.
- D. Copper pipe fittings shall be sweat type made up as described under "PIPE JOINTS" in Section 230030.
- E. Plastic fittings shall be made as described under "PIPE JOINTS" in Section 230030.

2.04 FLEXIBLE PIPE CONNECTIONS

- A. Provide flexible pipe connectors where shown on Drawings. Unless otherwise approved by Architect, connectors shall be flanged, 125 psig WOG and fabricated with stainless steel bellows and braided cover, length three times the pipe diameter.

2.05 DIELECTRIC FITTINGS

- A. Provide dielectric fittings with appropriate end connections for pipe materials in which to effectively isolate dissimilar metals (including copper to steel connections), to prevent galvanic action and stop corrosion. For water (liquid) piping systems 4 inch diameter or less, dielectric fittings shall be Victaulic Clearflow Style 47, Precision Plumbing Products Inc. (PPP) Clearflow, or equal as listed by addendum, dielectric piping "nipples" with inert thermoplastic lining. For water (liquid) piping systems larger than 4 inch diameter, dielectric fittings shall be same as specified below for air/gas piping systems (larger than 2 inch diameter). For air/gas piping systems 2 inch diameter and smaller, dielectric fittings shall be dielectric unions with isolating gasketing/seals, Watts 3000 Series, Legend T-57_ Series, Central (Plastics) Insulating Unions, or equal as listed by addendum. For air/gas piping systems larger than 2 inch diameter, dielectric fittings shall be piping flanges with flange isolation kits (including isolating/sealing gasket, bolt isolating sleeves and isolating washers).

2.06 UNIONS

- A. Install union connections at all pieces of equipment such as coils, pumps, tanks, etc., and all control valves. Where there is a valve at a piece of equipment, locate the union connection on the equipment side of the valve. No union shall be concealed in construction.
- B. Unions installed in sweated copper pipe shall be Crane No. 633, Nibco No. 633 or Grinnell Figure 9730. Unions 2-1/2 inches and larger shall be Grinnell Figure 463, Stockham Figure 698 or Nibco No. 733, standard malleable iron flange union with gasket.

3.01 GENERAL

- A. Install all equipment, piping and accessories as per manufacturer's requirements. Contractor shall review manufacturer's installation manual and install all components per manufacturer's requirements, whether shown on Drawings or not.
- B. Where allowed by the preceding Specifications, plastic piping below slabs, drives or other paved surfaces must be installed at minimum depth of 3'-0 inches below finished pavement.

END OF SECTION

SECTION 230050 - HVAC EQUIPMENT AND SPECIALTIES

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install all equipment as indicated on the Drawings, and specified hereinafter including requirements of Section 230000 - HVAC GENERAL REQUIREMENTS.
- B. Heating, Ventilating and Air Conditioning (HVAC) equipment shall meet or exceed applicable minimum efficiency requirements of the Louisiana Commercial Building Energy Code as adopted by the State of Louisiana. Currently, 2021 IECC is the applicable Energy Code.
- C. For equipment requiring field installation of refrigerant piping, the equipment manufacturer's representative shall be responsible for determining refrigerant line sizes and refrigerant accessories required to meet optimum performance as per equipment manufacturer's requirements; provide refrigerant suction accumulator and/or other accessories required for proper installation. Submit piping diagram for review. Contractor shall be responsible for installing refrigerant line sizes and accessories as per manufacturer's requirements and approved shop drawings.
- D. The Contractor shall verify that all equipment and materials provided for the project by him will fit and function within the space allowed. This includes the access to and the arrangement within the space. This requirement may require field breakdown and reassembly of the equipment.
- E. The Contractor installing the boiler shall be licensed by the State Fire Marshal for boiler installation.

PART 2 - PRODUCTS

2.01 PACKAGED ROOFTOP AIR CONDITIONERS, VAV TYPE, ELECTRIC HEAT

- A. General
 - 1. Units shall be specifically designed for outdoor rooftop installation on a roof curb and be completely factory assembled and tested, piped, internally wired, fully charged with compressor oil and shipped in one piece for field installation. Single piece units shall be fully charged.
 - 2. Units shall be available for direct expansion cooling and electric heating. Filters, outside air system, relief air system, non-fused disconnect switches and all operating and safety controls shall be furnished factory installed.
 - 3. Cooling capacity shall be tested in accordance with AHRI Standard 360. All units shall have decals and tags to aid in service and indicate caution areas. Electrical diagrams shall be printed on long life water resistant material and shall ship attached to control panel doors.
- B. Casing
 - 1. Exterior panels shall be zinc coated galvanized steel, phosphatized and painted with a slate grey air-dry finish durable enough to withstand a minimum of 672 hours consecutive salt spray application in accordance with standard ASTM B117. Screws shall be magnigard coated.

2. Refrigeration components and compressor shall be accessible through removable louvered panels as standard. Unit air handling section shall be laminated double-wall construction with polyurethane foam core injected between sheet metal panels and liners. Insulation value shall be R8. All interior surfaces shall be suitable for cleaning per ASHRAE 62. All access doors and panels shall have neoprene gaskets. Unit base shall be watertight with heavy gauge formed load bearing members and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tie down points.

C. Access Doors

1. Doors of laminated double wall construction with a polyurethane foam core between the exterior sheet metal pane and the interior liner, with an insulating value of R8 shall be provided on the air handlers serviceable compartments such as return/relief fan, filters, evaporator coil, and blank sections. Two single wall doors shall be provided for access to the control panel.

D. Airflow Path

1. Unit shall have downflow discharge conditioned air path. Return airflow path shall be upflow.

E. Burglar Bars

1. A grate system shall be installed in supply and return air duct connection areas on non-horizontal airflow path units to minimize unwanted intrusion into duct systems.

F. Belt Guard

1. Supply and relief fans shall have a universal size belt guard to accommodate any applicable drive configuration. The guard shall completely enclose the drive system and is provided with a two-piece removable front panel for servicing. Return fan guards shall be individually sized with a single piece removable panel for servicing.

G. Refrigeration System

1. eFlex™ Variable Speed Compressors
 - a. The Trane eFlex™ variable speed compressor shall be capable of speed modulation from 25 Hz to a maximum of 100 Hz. The minimum unit capacity shall be 15% of full load or less. The compressor motor shall be a permanent magnet type. Each compressor shall have a crankcase heater installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles. Compressors shall be equipped with a bearing oil injection system that optimizes scroll set lubrication, sealing, and controls the oil circulation rate.
 - b. Optimal bearing lubrication shall be provided by a gerotor oil pump. Each variable speed compressor shall be matched with a specially designed variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions. Control of the variable speed compressor and inverter control shall be integrated with the IntelliPak unit controller to ensure optimal equipment reliability and efficiency.

2. Supply Fan

- a. Standard airflow supply fan shall have a single fan assembly with double width, double inlet, airfoil fan, motor and fixed pitch sheave drive. All fans shall be statically and dynamically balanced for the operating envelop. It shall be tested in the factory. Supply fans shall be test run in unit as part of the unit test. Fan operating envelop rpm shall be below first critical speed. Fan shafts shall be mounted on two grease lubricated ball bearings designed for 200,000 hours average life.
- b. Extended grease lines shall allow greasing of bearings from section base rail. Fan motor and fan assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assemblies shall be completely isolated from unit by two-inch deflection spring isolators.

3. Evaporator Coil

- a. Internally enhanced copper tubing of 1/2-inch O.D. shall be mechanically bonded to heavy-duty aluminum fins of configured design. All coils shall be equipped with electronic expansion valves, and are factory pressure and leak tested. A double sloped stainless steel drain pan shall be provided to drain condensate to both sides of the unit.

4. Stainless Steel Drain Pans

- a. Drain pan shall be stainless steel, double sloped, and located under the evaporator coil in order to promote runoff of standing water from condensation inside the unit as well as provide protection in corrosive environments. Two drain pipes shall be installed through the base channel on each side of the unit.

5. Hot Gas Bypass

- a. The hot gas bypass shall consist of valves, piping and controls that are all included on circuit 1 to allow operation at low airflow, avoiding coil frosting and damage to the compressor. When saturated suction temperature falls below controls adjustable setpoint, the valve shall modulate hot gas to the inlet of the evaporator.

6. Filter Drier

- a. Removable core filter driers shall be installed on each refrigeration circuit. For easy access, the filter driers are conveniently located in the condenser section close to the periphery of the unit.

7. Suction Service Valves

- a. Each compressor shall be equipped with a suction service valve in order to facilitate compressor servicing.

8. Leak Detection Sensors
 - a. Unit shall be furnished with a leak detection system from the factory when a circuit refrigerant charge exceeds 3.91 lbs. The leak detection system shall consist of one or more refrigerant detection sensors. When the system detects a leak, the unit controller shall initiate mitigation actions.
- H. Air-Cooled Condensing
 1. Air-Cooled Condenser Coil
 - a. Condenser coils shall have all-aluminum, Microchannel coils. All coils shall be leak tested at the factory to ensure pressure integrity. The condenser coil shall be pressure tested to 650 psig. Subcooling circuit(s) shall be provided as standard.
 2. Air-Cooled Condenser Fans and Motors
 - a. All condenser fans shall be vertical discharge, direct drive fans, statically balanced, with steel blades and zinc plated steel hubs. Condenser fan motors shall be totally enclosed three-phase motors with permanently lubricated ball bearings, built-in current and thermal overload protection and weather tight slingers over motor bearings.
- I. Electrical
 1. Unit shall be completely factory wired with necessary control and contactor pressure lugs or terminal block for power wiring. Units shall provide an internal location for a non-fused disconnect with external handle for safety.
- J. System Controller
 1. The Symbio 800 controller is an application-specific, programmable controller that is factory installed and designed to control packaged HVAC equipment. A 7-inch user interface features a touch-sensitive color screen that provides facility managers with at-a-glance operating status, performance monitoring, scheduling changes, and operating adjustments. Other advanced features include automated controller backup, secure remote connectivity, wireless building communications, mobile device connectivity, and custom programming with expandable I/O.
 2. System controller communication interface shall utilize the BACnet protocol with an Ethernet (IEEE 802.3) or RS485 (EIA-485) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet/IP, BACnet/MSTP). The rooftop controller shall be BTL listed as a BACnet Advanced Application Controller (B-AAC) as defined in ANSI/ASHRAE Standard 135-2012.
 3. Rooftop controller communication interface shall utilize the BACnet protocol with a ZigBee (IEEE 802.15.4) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. Wireless communication shall utilize open standard protocols, of which BACnet and ZigBee shall be considered appropriate. This requirement will require field installation.
 4. Each rooftop controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.
 5. Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone

applications. Sensing options shall include temperature, relative humidity, CO₂, and occupancy.

K. Power Monitor

1. Factory installed power meter shall measure unit energy usage to 0.2 percent accuracy (ANSI C12.20) and communicate through the Symbio™ 800 controller enabling viewing through user interface or building automation system.

L. Ambient Control

1. Variable speed condenser motors shall be provided to allow the unit to operate down to 0°F.

M. Controls Expansion Hardware

1. The rooftop controller shall have field applied controls capability. Factory installed expansion hardware (XM70) shall have 19 inputs/outputs. Additional expansions may be added in the field.

N. Rapid Restart

1. Provides for immediate start-up upon power failure. A backup generator shall be required on site before unit start-up. Rapid Restart shall begin immediately after recovery from a power loss and work by restarting the compressors and supply fan quickly to provide full cooling within 3 to 4 minutes.

O. System Control Options

1. Provide unit with Multi Zone Variable Air Volume (Discharge Air Temperature) controls to operate a VAV rooftop from the discharge air temperature, including discharge air microprocessor controller and discharge air sensor.
2. Variable Frequency Drive (VFD) Bypass of the supply fan bypass control provides airflow at 60Hz in the event of drive failure.

P. Electrical System

1. Air-cooled rooftops shall be of 460 voltage, 3 phase, 60 hertz power supply.
2. A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed field wired. A unit mounted, non-fused disconnect with internal handle shall be furnished with the factory powered convenience outlet.
3. An external handle mounted on the control box door shall be provided to disconnect unit power with the control box door closed for safety.
4. Compressor Protection Modules shall be included in the junction box to protect compressors against reverse rotation.
5. A customer-provided 120V service shall supply power to a fused disconnect switch which feeds a transformer providing class 2, 24V power to the LED Marine Lights. The LED Marine Lights shall be placed in the Supply Section (2), Outside Air Section (1), Return Section (1), and Extended Casing Section (1) for units without heat.
6. Supply, relief/return motors shall be totally enclosed fan cooled (TEFC). All 60 Hz motors meet the Energy Independence and Security Act of 2007 (EISA). Motors for VFD service shall have internal Shaft grounding rings for use with VFD applications

and shall provide a conductive discharge path away from the motor bearings to ground.

Q. Filters

1. Filter options shall mount integral within the unit and be accessible by a hinged access door with a single point latching device.
2. Shall be provided as standard-U.L. Class 2, two-inch nominal thickness, high efficiency pleated media filters rated MERV 13 per ASHRAE 52.2. Filters shall be provided mounted in a galvanized steel filter rack.

R. Relief Air

1. 100 Percent Modulating Relief Fan with Statitrac Control Option
 - a. Fan design is double width, double inlet forward-curved type. Fan is mounted on a shaft with fixed sheave drive. All fans are dynamically balanced and tested in factory before being installed in unit. Relief fan is test run as part of unit final run test.
 - b. Fan operating envelop rpm is be below first critical speed. Fan shaft is be mounted on two grease lubricated ball or roller bearings designed for 200,000-hour average life. Extended grease lines are provided to allow greasing of bearings from section base rail.
 - c. Fan motor and assembly is mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. The entire assembly is completely isolated from unit with 2-inch spring isolators. For VAV rooftops, the 100 percent modulating relief discharge damper (or VFD) is modulated in response to building pressure. A differential pressure control system, (Statitrac), uses a differential pressure transducer to compare indoor building pressure to outdoor ambient atmospheric pressure. The FC relief fan is turned on when required to lower building static pressure setpoint.
 - d. The (Statitrac) control system then modulates the discharge dampers (or VFD) to control the building pressure to within the adjustable, specified deadband that shall be adjustable at the user interface. Optional bypass can be factory installed to provide full nominal airflow in the event of a drive failure.

S. Outside Air

1. 0-100 Percent Modulating Economizer Option
 - a. Economizer is operated through the primary temperature controls to automatically utilize OA for "free" cooling. Automatically modulated return and OA dampers maintains proper temperature in the conditioned space. Economizer is equipped with an automatic lockout when the outdoor high ambient temperature is too high for proper cooling. Minimum position control is standard and adjustable at the user interface or with a remote potentiometer or through the building management system. A spring return motor ensures closure of OA dampers during unit shutdown or power interruption. Mechanical cooling is available to aid the economizer mode at any ambient.
 - b. Standard ultra low leak damper will have added sealing under the jam seals and in the frame. The ultra low leak dampers have a leakage rate of 4 CFM/ft² (AMCA Class 1) at 1.0 in W.C. pressure difference.

- c. Fault Detection and Diagnostic (FDD) control shall be provided with Ultra Low Leak Economizers. FDD control monitors the commanded position of the economizer compared to the feedback position of the damper. If the damper position is outside ± 10 percent of the commanded position, a diagnostic is generated. Intellipak units ordered with Ultra Low Leak Economizers are listed on the California Energy Commission Registry for factory compliance with Title 24 Economizer and FDD requirements. A label is applied to the unit identifying construction with the Ultra Low Leak Economizer and FDD controls.
- d. Economizer Control with Comparative Enthalpy includes two enthalpy sensors to compare total heat content of the indoor air and outdoor air to determine the most efficient air source when economizing.
- e. A factory mounted airflow measurement station (Traq) is provided in the outside air opening to measure airflow. The airflow measurement station is AMCA certified ($\pm 5.0\%$) from 300fpm to 2500fpm. The airflow measurement station adjusts for temperature variations.

T. Electric Heating

- 1. All electric heat models shall be completely assembled and have wired electric heating system integral within the rooftop unit. Heavy duty nickel chromium elements internally wired with a maximum density of 40 watts per square inch shall be provided. Heater circuits shall be 48 amps or less, each individually fused. Automatic reset high limit control shall operate through heater backup contactors. The 460 volt electric units shall have factory mounted non-fused disconnect switch located in the main control panel to serve the entire unit.

U. Roof Mounting Curb

- 1. Roof mounting curb shall be heavy gauge zinc coated steel with nominal two-inch by four-inch nailer setup. Supply/return air opening gasketing shall be provided. Curb shall ship knocked down for easy assembly. Channel shall be provided to allow for adjustment of return air opening location. Curb shall be manufactured to National Roofing Contractors Association guidelines.
- 2. Curb shall be minimum 24 inches tall.
- 3. Entire assembly (unit and curb) shall be rated to withstand a wind load of 140 MPH without the use of guy wires. Manufacturer to provide all installation requirements.

V. Electronic Zone Sensors

- 1. VAV Zone Sensor is provided with supply air single temperature setpoint and AUTO/OFF system switch. Sensor is provided for zone temperature control with VAV units. VAV units are not compatible with SZVAV units.
- 2. Fast Warmup Sensor is used as morning warmup sensor with VAV units.

W. CO₂ (Carbon Dioxide) Sensing

- 1. The CO₂ sensor shall have the ability to monitor space occupancy levels within the building by measuring the parts per million of CO₂ in the air. As the CO₂ levels increase, the outside air damper modulates to meet the CO₂ space ventilation requirements.

X. High Duct Temperature Thermostats

1. Two temperature sensors, Discharge Air and Return Air shall be used to determine if duct temperatures are excessively high. If the discharge air temperature exceeds 200°F or if the return air temperature exceeds 135°F, the unit will be placed into Emergency Stop Mode.

Y. Trane Start-Up

1. A Trane technician shall provide unit start-up after the unit is properly installed. The installation shall include:
 - a. Unit and all ship-with items installed
 - b. All utilities and drain pipes connected
 - c. All refrigerant piping reconnected and all refrigerant charge adequately distributed throughout the system
 - d. All ductwork attached to the unit

Z. Prior to Trane Unit Start-Up

1. Prior to Trane start-up, the following work should be inspected and verified:
 - a. Unit inspection – Cabinet
 - 1) Review the overall unit for exterior damage (dents, bends, missing panels, doors working properly, etc). Verify the unit interior is free from debris/obstructions, the panels and doors are secured properly, the unit clearances are adequate to avoid air recirculation, and that the unit drain lines and traps are properly installed.
 - b. Wiring
 - 1) Review the unit main power to ensure that the unit is properly grounded, the main power feed wire gauge is adequately sized, the correct voltage is supplied to the unit and electric heaters (if applicable), and the incoming voltage is phase balanced. Verify that all wiring connections are tight, all field installed control wiring is landed on correct terminals, and that all automation and remote controls, along with control wiring for VAV controls, are correctly installed/wired.
 - c. Refrigeration system
 - 1) Review the refrigeration system to ensure the coil fins are straightened, shipping hardware and plastic covers for compressors have been removed, compressors contain the correct oil level, service valves are in the correct position, and the crankcase heaters have been operational for at least 12 hours prior to Trane start-up.

d. Fans

- 1) Check the unit fans to ensure the condenser fan blade set-screws to the motor shaft are tight, hold down bolts and channels from fan sections have been removed, proper adjustment of fan section spring isolators, proper fan belts tension, adequate fan bearings greased, alignment of fan sheaves, adequate tightness of supply and relief fan pulley bolts, proper fan rotation, and proper fan motor amperage.

e. Economizer

- 1) Check all damper linkages for proper adjustment. Verify proper damper operation and outside air pressure sensors.

f. Electric Heat

- 1) On units equipped with electric heaters, check to ensure the heating system matches the unit nameplate and verify that the correct voltage is supplied to the heaters.

AA. Trane Unit Start-Up

1. After the unit installation has been fully completed, a Trane technician shall do the following:
 - a. Verify and log supply fan operation, proper compressor operation, and condenser fan operation, as well as correct levels of superheat and subcooling.
 - b. Verify operation of all VAV modes per job requirements, which include: Supply Air Cooling and Heating, Daytime Warmup, Morning Warmup, and Supply Air Tempering.
 - c. Space pressure control — Verify that unit is sensing field installed building pressure input.
 - d. Economizer — Adjust outside air travel and verify all sensor inputs.
 - e. Dehumidification — Verify that dehumidification mode operates correctly and is set up per job requirements.
 - f. Outside Air Measurement — Verify that there is correct Traq damper linkage and actuator operation, as well as matched left and right air flow. Verify that Demand Flow Ventilation function is correct.
 - g. All units — Verify user interface programming, including setpoints and sensor sources per customer requirements. Leave the unit in a running state or off per customer requirement. Once the IntelliPak® unit start-up is complete, provide a start-up activities communication and the associated operating log.

BB. Certified AHRI Performance

1. Packaged Rooftop units cooling, heating capacities and efficiencies shall be rated within the scope of the Air-Conditioning, Heating and Refrigeration Institute (AHRI) Certification Program and display the AHRI Certified® mark as a visual confirmation of conformance to the certification sections of AHRI Standard 340-360 (I-P) and ANSI Z21.47 and 10 CFR Part 431 pertaining to Commercial Warm Air Furnaces.

2.02 PACKAGED, ROOFTOP, AIR-CONDITIONERS, CONSTANT VOLUME, ELECTRIC HEAT, HOT GAS REHEAT HUMIDITY CONTROL

A. Basis of Design: TRANE PRECEDENT SERIES

1. Precedent unit cooling capacities, heating capacities, and efficiencies are certified to the following standards:
 - a. 3 to 5 ton units: AHRI Standard 210/240.
 - b. 6 to 25 ton units: AHRI Standard 340/360.
2. Symbio controls operating range between 0°F and 125°F in cooling mode standard from the factory.
3. Factory assembled, internally wired, fully charged, and 100 percent run tested to verify cooling operation, fan and blower rotation, and control sequence.
4. Colored and numbered wiring internal to the unit for simplified identification.
5. cULus listed and classified in accordance for Central Cooling Air Conditioners.

B. Casing

1. Zinc coated, heavy gauge, galvanized steel.
2. Weather resistant pre-painted metal with galvanized substrate.
3. Meets ASTM B117, 672 hour salt spray test.
4. Single side maintenance through hinged access panels.
5. Exposed vertical panels and top covers in the indoor air section insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material.
6. Base pan with no penetrations within the perimeter of the curb other than the raised 1-inch downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.
7. Base of the unit insulated with 1/8-inch, foil-faced, closed-cell insulation.
8. Unit base provisions for forklift and/or crane lifting on three sides of unit.

C. Microchannel Coils

1. Optimal heat transfer performance due to flat, streamlined tubes with small ports, and metallurgical tube-to-fin bond.
2. Reduced system refrigerant charge by up to 50 percent leading for better compressor reliability.
3. Compact all-aluminum microchannel coils to reduce the unit weight.
4. All-aluminum construction to minimize galvanic corrosion.
5. Strong aluminum brazed structure to provide better fin protection.
6. Flat streamlined tubes for more dust resistance and easy cleaning.
7. Coils leak tested at the factory to verify the pressure integrity.

D. Coil Guards

1. Provide for condenser coil protection.

E. Compressors

1. All units shall have a variable speed compressor matched with a variable frequency drive that modulates the speed of the compressor motor and provides added compressor protection functions.
2. Permanent magnet motor with voltage utilization range of plus or minus 10 percent of unit nameplate voltage.

3. Crankcase heaters sized to minimize the amount liquid refrigerant present in the oil sump during off cycles are standard on all compressors.
 4. Single variable speed compressors in 3 to 15 ton units.
 5. Variable speed modulation to 15 Hz equating to 27% or less of full capacity
 6. Control of the eFlex system is integrated with the Symbio™ 700 unit controller to ensure optimal equipment reliability and performance.
- F. Filters
1. 2-inch MERV 13 filters.
- G. Froststat
1. Used as a safety device.
 2. Opens to prevent freezing temperatures on evaporator coil.
 3. Closes when temperature rises to 50°F.
 4. Utilized in low airflow or high outside air applications (cooling only).
- H. Indoor Fan
1. Direct drive plenum fan design.
 2. Plenum fan design — backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor.
 3. Supply fan speed adjustments can be made using the Symbio™ 700 or Mobile App.
 4. Motors are electronically protected.
 5. Variable speed direct drive motors shall be high efficiency type.
- I. Unpowered Convenience Outlet
1. Factory Unpowered GFCI, 120V/20A, 2 plug, convenience outlet.
 2. Convenience outlet is powered from the line side of the disconnect or circuit breaker, and will not be affected by the position of the disconnect or circuit breaker.
- J. Stainless Steel Drain Pan
1. Corrosion and oxidation resistance.
 2. Constructed of 304 stainless steel.
- K. Through-the-Base Electrical with Disconnect Switch
1. 3-pole, molded case, disconnect switch with provisions for through-the-base electrical connections.
 2. Disconnect switch installed within unit in a water tight enclosure.
 3. Wiring provided from the switch to the unit high voltage terminal block.
 4. Switch cULus agency recognized.
 5. Size per NEC requirements.
- L. Standard Economizer
1. With barometric relief.
 2. Fully modulating 0 to 100 percent motor and dampers, minimum position setting, preset linkage, wiring harness with plug, spring return actuator and comparative/differential enthalpy control.

3. Barometric relief provides a pressure-operated, gravity-closing damper.
4. Barometric relief prevents entrance of outside air during the equipment **off** cycle.
5. Arrives in shipping position and must be switched to operating position by the installing contractor.

M. Electric Heaters

1. Constructed of heavy-duty nickel chromium elements internally wye connected for 480V.
2. Staging achieved through Symbio™ controller.
3. Multiple automatic reset and single operation high temperature limit controls operating to break line power to the heater element.
4. Heaters individually fused from the factory.
5. Meets all NEC and CEC requirements when properly installed.
6. Power assemblies provide single-point connection.
7. Modules are cULus listed.

N. Roof Curb

1. Designed to connect with the unit's downflow supply and return.
2. Provides support and a water tight installation when installed properly.
3. Allows field-fabricated rectangular supply/return ductwork to be connected directly to the curb.
4. Curb shipped knocked down for field assembly.
5. Includes wood nailer strips.
6. Curb shall be minimum 24 inches tall.
7. Entire assembly (unit and curb) shall be rated to withstand a wind load of 140 MPH without the use of guy wires. Manufacturer to provide all installation requirements.

O. Leak Detection Sensors

1. Unit shall be furnished with a leak detection system from the factory when a circuit refrigerant charge exceeds 3.91 lbs. The leak detection system shall consist of one or more refrigerant detection sensors. When the system detects a leak, the unit controller shall initiate mitigation actions.

2.03 ELECTRIC AIR COILS

- A. This Specification shall apply to all electric heating systems, separate duct heaters, unit heaters and factory supplied heaters as part of packaged systems.
- B. Heating coils shall be UL listed and be as manufactured by unit supplier or shall be Indeeco Type QUA, Redd-i Heat Model R, or equal as listed by addendum. Coils shall be integral to cabinet or may be for duct installation with insulation to prevent condensation. Coil shall be complete with automatic primary reset, thermal cut-out and magnetic contactor for each stage, pre-wired and mounted on the coil. **Contactors must be all phase disconnecting type.** In addition, the control panel shall contain a supplementary manual reset. The unit shall comply with all NEMA and NEC regulations. Disconnect switches for each coil shall be included in the control panel and be of the cabinet interlocking fused disconnect type. Fuses shall be for all phases and rated at full current delta or wye connected. Provide control voltage transformer as required for coordination with the control voltage required by the Temperature Controls Supplier. Provide pressure differential airflow switch factory mounted, wired and piped. Coordinate with the Temperature Controls Supplier for calibration and

sequence of operation required. Coils to be derated for maximum density of 35 watts per square inch and be of the 80% nickel, 20% chromium composition type. All terminals shall be stainless steel tubular crimped type not screw post type, and all factory wiring shall be Grade "A".

- C. Position coils so that clearance of 36 inches is maintained in front of panel for at least a 30 inch width and hinged door is free to open to 90 degrees.
- D. Coils listed to have multiple stages shall have equally sized steps.

2.04 FANS

- A. Fans shall be constructed in accordance with AMCA standards with ratings certified in accordance with the "Standard Test Code for Centrifugal and Propeller Fans" as adopted by the AMCA and ASHRAE.
- B. Curb-Roof Mounted Fans:
 - 1. Roof mounted fans to be spun aluminum, belt driven or direct drive type as specified.
 - 2. Fan shall be listed by Underwriters Laboratories (UL 762) (required for kitchen hoods only). Fan shall bear the AMCA certified ratings seal for sound and air performance.
 - 3. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The windband shall have a rolled bead for added strength. A two piece top cap shall have quick release latches to provide access into the motor compartment. An external wiring compartment with integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. A one inch thick, three pound density foil backed heat shield shall be utilized to protect the motor and drive components from excessive heat (required for kitchen hood exhaust only). Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.
 - 4. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-96, balance quality and vibration levels for fans.
 - 5. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. See Section 230010 - MOTORS AND MOTOR STARTERS.
 - 6. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
 - 7. Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.
 - 8. Fans shall be Greenheck Model CUE series.

9. Provide 24 inch high (unless noted otherwise on drawings) prefabricated factory roof curb, all aluminum constructed with flashing flanges and cants, nailer strip all designed to support the weight and slope of the fan assembly.
10. Roof mounted fans (and curbs) shall be designed, tested, certified, and installed to resist high wind (up to 150 MPH) conditions.

C. Ceiling, Wall or Inline Mounted, Direct Driven, Centrifugal Exhaust Fans:

1. The fan housing shall be galvanized steel and acoustically insulated. Blower and motor assembly shall be mounted to a reinforcing channel. Motor shall be resiliently mounted. Unit shall be supplied with integral wiring box. Discharge position shall be convertible from right angle to straight through by moving interchangeable panels. The outlet duct collar shall include reinforced aluminum dampers with continuous aluminum hinge rods and brass bushings. To accommodate different ceiling thickness, an adjustable pre-punched mounting bracket shall be provided. A powder painted white steel grille shall be provided as standard. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.
2. Wheels shall be twin DWDI centrifugal forward curved type, constructed of galvanized steel. Wheel shall be balanced in accordance with AMCA Standard 204-96, balance quality and vibration levels for fans.
3. Motor shall be open drip proof type with permanently lubricated sealed bearings and built-in thermal overload protection. See Section 230010 - MOTORS AND MOTOR STARTERS. Provide factory, built-in, speed controller.
4. Fan shall be Cook Gemini GN series, Greenheck Model SP, or equal as listed by addendum.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install equipment as per manufacturer's requirements.

END OF SECTION

SECTION 230060 - HVAC TEMPERATURE CONTROLS

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Building Management and Control System (BMCS), utilizing Direct Digital Controls as shown on the Drawings and as described herein. The BMCS shall be capable of total integration of the facility infrastructure systems with user access to all system data either locally over a secure network within the building or by remote modem accessible dial-in capability. This shall include HVAC control, and all reporting and maintenance management functions related to normal building operations all as indicated on the Drawings or elsewhere in this Specification.
- B. Include all submittals, data entry, electrical installation, programming, start up, test and validation acceptance documentation and system warranty. Refer to Section 230000 - HVAC GENERAL REQUIREMENTS.
- C. The complete temperature control system shall be DDC with electronic sensors and electric/electronic actuation of valves and dampers. All wiring required in the control system and all interlocking motor control wiring and start-stop control wiring shall be furnished and installed as part of the work of this section of Division 23. The control system shall include all interconnecting wiring and conduit as required for a fully operational system as specified. All line voltage wiring and low voltage wiring shall utilize methods and materials complying with the requirements of DIVISION 26 - ELECTRICAL.
- D. The control system shall consist of all thermostats, valves, dampers, transformers, relays and other necessary equipment to provide controls for all phases of the cooling, heating and ventilating systems as required.
- E. The Temperature Controls Contractor shall furnish and install a Magnehelic pressure gauge with sensor probes and tubing to measure differential air pressure across the (final) rigid filter section, typical for each air unit. Mount gauge to unit enclosure.
- F. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office. The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the local factory authorized temperature control contracting field office.
- G. The Contractor shall be responsible for all controllers, control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring.
- H. The Building Management and Control System (BMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility for connection as a Web Based Accessed Facility. The NAC shall connect to a Local Area Network (LAN). Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Provide interface devices, software and connections as required.

- I. Contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, Web Browser pages, as applicable, setup of schedules, logs and alarms, LonWorks network management and connection of the NAC to the local or wide area network.

1.02 INSTRUCTIONS TO BIDDERS

- A. The system specified in this document shall be manufactured by Trane. Temperature Controls Contractor must have local office with full service staff within 30 mile radius of Baton Rouge.

1.03 WORK BY OTHERS

- A. Valves, flow meters, water pressure and differential taps, flow switches and thermal wells shall be set in place by Contractor installing piping. Dampers, airflow stations and access doors shall be set in place by the Contractor installing ductwork. Furnishing and installing duct smoke detectors shall be under Division 28.

1.04 CODES AND APPROVALS

- A. The complete BMCS installation shall be in strict compliance to the national, state and local mechanical and electrical Codes and Division 26 of these Specifications. All devices shall be UL or FM listed and labeled for the specific use, application and environment to which they are applied. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air Conditioning.
- B. System shall be designed and manufactured to ISO 9001 quality standard, and all electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.
- C. The unitary controllers, intelligent sensors, and intelligent actuators shall be based upon BACnet functional profile configurations.
- D. All products of the BMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package.
 1. UL-916: Energy Management Systems
 2. ULC: UL-Canadian Standards Association
 3. FCC, Part 15, Subpart J, Class A Computing Devices

1.05 WARRANTY

- A. All components, system software, and parts supplied by the Temperature Controls Contractor shall be guaranteed against defects in materials and workmanship for one year from the final project acceptance date by the Owner. The Temperature Controls Contractor, at no charge, shall furnish labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the Owners request for warranty service within 24 hours during normal business hours.

1.06 REMOTE ACCESS

- A. The Owner shall grant to the Contractor, reasonable access to the BMCS during the warranty period. The Owner shall allow the contractor to access the BMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

1.07 SPECIFICATION NOMENCLATURE

- A. The following are acronyms which may be used in this Specification:

1.	BMCS	Building Management and Control System
2.	NAC	Network Area Controller
3.	GUI	Graphical User Interface
4.	PMI	Power Measurement Interface
5.	DDC	Direct Digital Controls
6.	SSL	Secure Socket Layer
7.	LAN	Local Area Network
8.	OOT	Object Oriented Technology

PART 2 - PRODUCTS**2.01 GENERAL**

- A. The Building Management Control System (BMCS) shall be comprised of a network of stand-alone digital controllers, a graphical user interface computer system, software, network devices and other devices as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall BMCS.

2.02 ARCHITECTURES

- A. The intent of this Specification is to provide a peer-to-peer network of interoperable, stand-alone digital controllers communicating on an open protocol communication network to a host computer within the facility and communicating via the internet to a host computer in a remote location. The BMCS shall include the software and hardware ability to communicate to third party systems such as chillers, boilers, air handling systems, energy metering systems, other energy management systems, access control systems, fire-life safety systems and other building management related devices with open, interoperable communication capabilities. Controllers/modules shall be standalone open Echelon (Lon Mark) interoperable.
- B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- C. The supplied system must incorporate the ability to access all data through the proprietary operator interface and configuration programs. The installed system shall provide secure password access to all features, functions and data contained in the overall BMCS. Secure Socket Layer (SSL) encryption shall be an available option for remote access.

- D. The installed system must be totally scalable to allow for future expansion with the addition of controllers and/or input/output devices. It shall not be necessary to remove equipment supplied under this contract to expand the system.
- E. The failure of any single component or network shall not interrupt the control functions of non-affected devices. A single network failure shall only affect shared communications or shared data; individual application controllers and network controllers shall continue normal operation minus only the data from a remote device from the affected network. Automatic default values for all network transported data shall be provided to allow continued operation until the network is restored.
- F. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
- G. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
- H. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.03 NETWORKS

- A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), and user workstation.

2.04 NETWORK ACCESS

A. Remote Access:

- 1. Provide web based access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

B. DDC Controllers:

- 1. HVAC control shall be accomplished using DDC based controllers. All programming, documentation and programming tools necessary to set up and configure the supplied controllers per the specified sequences of operation shall be provided.
- 2. All control sequences within or programmed into each controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- 3. Each controller shall communicate with the NAC at a baud rate of not less than 19K baud. Each controller shall provide LED indication of communication and controller performance to the technician, without cover removal.

4. Each DDC controller shall be operational as standalone devices configured to perform the sequences specified, and with I/O selected for the application. Controllers shall be tested and listed under UL916 for Energy Management computing devices. Each controller shall be provided with a face mounted LED type annunciation to continually display its operational mode: power, normal, or in an alarm state. The controller shall have spare Inputs/Outputs for future expansion.
5. Each DDC controller shall be configured for DIN rail mounting using industry standard clip on adapters or direct panel mounted. Each controller shall be designed with on-board jacks for quick commissioning and troubleshooting with a portable programming tool. This connection shall be extended to a space temperature port where indicated and shown on plans.
6. DDC Controllers shall be standalone EEPROM based configured to perform the sequences specified, and with I/O selected for the application. Enclosures for controller shall be flame retardant compact plastic conforming to UL94-V5 for plenum mounting or plated steel.

C. Air Unit and Fan Coil Unit Controllers:

1. For each air unit and fan coil unit, provide a stand alone DDC Controller featuring preprogrammed heating and cooling and ventilation control algorithms configurable to match each unit application. Separate unoccupied heating and cooling setpoints shall be provided. A standby feature shall be provided to reset the occupied temperature set point back to a user definable limit based on status from an auxiliary device, such as an occupancy sensor.
2. The Temperature Controls Contractor shall furnish and ship damper actuators (if required) and Unitary DDC Controllers (if required) to the equipment manufacturer for factory installation. The Temperature Controls Contractor shall provide the equipment manufacturer with necessary wiring and mounting instructions.
3. For each variable air volume (VAV) air unit application, controller shall include a temperature wall module connection that may be used in applications where the wall module must: sense temperature, control set point temperature and control Occ/Unocc condition. In addition to internal I/O selected for the application, controller shall also support distributed I/O from the network. Also for VAV air units, controller application software shall include setpoint resets for energy demand limit control, Outside Air minimum position for Indoor Air Quality (IAQ) control, fan speed control, and discharge air temperature control.

D. Input/Output Module:

1. Provide a remote input/output module that connects sensors and actuators onto the field bus network for use by the BMCS and Unitary DDC Controllers. I/O Device shall have extended operating temperature rating from -40°F to +150°F so Device can be mounted directly in wiring cabinet of monitored appliances.

E. VAV Terminal Box Controllers:

1. For each VAV terminal box, provide a standalone DDC VAV terminal unit controller for factory mounting featuring preprogrammed heating and cooling control algorithms. Controller shall be designed to work with pressure independent units and pressure dependent units. Pressure independent units shall contain a default algorithm to revert to pressure dependent mode on failure of the flow sensor. Controller shall be configurable for the following options: No Fan, Series Fan, Parallel Fan, Three Stages of Reheat or Modulating, Peripheral Radiation Control,

Dual Duct, Exhaust Tracking, Occupancy Sensor, Window Sensor, Shared or Direct Wired Wall Module.. Controller application software shall include; set point reset for energy demand limit control or outdoor air compensation, optimum start, night purge and morning warm-up. A standby feature shall be provided to reset the occupied temperature set point back to a user definable limit based on status from an auxiliary device, such as an occupancy sensor or window contact. In addition to internal I/O selected for the application, controller shall also support distributed I/O from the network.

2. The Temperature Controls Contractor shall furnish and ship damper actuators and VAV Box Controllers to the terminal equipment manufacturer for factory installation. The control contractor shall provide the terminal equipment manufacturer with necessary wiring and mounting instructions. Any mounting charges shall be the responsibility of the equipment manufacturer.
3. VAV box controllers shall have configured airflow calibration software for VAV applications to assist the test and balance (T&B) contractor in final calibrations. Using the controls contractors calibration tool, the T&B contractor shall be provided with a display allowing a simple command entry to place the VAV box controller in zero, minimum, and maximum CFM control modes. At each mode, a display field shall be provided for the T&B contractor to enter the actual measured value in CFM. Upon completion of entering the three values, the VAV box controller shall automatically recalibrate based upon the actual values.

2.05 NETWORK AREA CONTROLLER (NAC)

- A. Contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided and existing. It is the responsibility of this Contractor to coordinate with the Division 23 and 26 contractors to determine the quantity and type of devices.
- B. The Network Area Controller (NAC) shall provide the interface between the LAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
 1. Calendar functions
 2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Time synchronization
 6. Integration of LonWorks controller data
 7. Network Management functions for all LonWorks based devices
- C. The Network Area Controller must provide the following hardware features as a minimum:
 1. One Ethernet Port - 100 Mbps
 2. One RS-232 port
 3. One LonWorks Interface Port – 78KB FTT-10A
 4. Battery Backup
 5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 6. The NAC must be capable of operation over a temperature range of 0 to 55°C

7. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C
 8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing
- D. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- E. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- F. Event Alarm Notification and Actions:
1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 5. Provide timed (schedule) routing of alarms by class, object, group, or node.
 6. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
 7. Control equipment and network failures shall be treated as alarms and annunciated.
 8. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text.
 - b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - 1) Day of week
 - 2) Time of day
 - 3) Recipient
 - c. Pagers via paging services that initiate a page on receipt of email message
 - d. Graphic with flashing alarm object(s)
 - e. Printed message, routed directly to a dedicated alarm printer
 9. The following shall be recorded by the NAC for each alarm (at a minimum):
 - a. Time and date
 - b. Location (building, floor, zone, office number, etc.)
 - c. Equipment (air handler #, accessway, etc.)

- d. Acknowledge time, date, and user who issued acknowledgment.
- e. Number of occurrences since last acknowledgment.

- 10. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- 11. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- 12. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- 13. Provide a "query" feature to allow review of specific alarms by user defined parameters.
- 14. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- 15. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

G. Data Collection and Storage:

- 1. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
- 2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - a. Designating the log as interval or deviation.
 - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- 3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
- 4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- 5. All log data shall be available to the user in the following data formats:
 - a. HTML
 - b. XML
 - c. Plain Text
 - d. Comma or tab separated values
- 6. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - a. Archive on time of day
 - b. Archive on user-defined number of data stores in the log (buffer size)

- c. Archive when log has reached its user-defined capacity of data stores
- d. Provide ability to clear logs once archived

H. Audit Log:

- 1. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
 - a. Time and date
 - b. User ID
 - c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

I. Database Backup and Storage:

- 1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- 2. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- 3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.06 GRAPHICAL USER INTERFACE SOFTWARE

A. Operating System

- 1. The GUI shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.
- 2. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

B. Real-Time Displays.

C. The GUI, shall at a minimum, support the following graphical features and functions:

- 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
- 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.

3. Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration:

1. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
 - a. Create, delete or modify control strategies.
 - b. Add/delete objects to the system.
 - c. Tune control loops through the adjustment of control loop parameters.
 - d. Enable or disable control strategies.
 - e. Generate hard copy records or control strategies on a printer.
 - f. Select points to be alarmable and define the alarm state.
 - g. Select points to be trended over a period of time and initiate the recording of values automatically.

E. On-Line Help:

1. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security:

1. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics:

1. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console:

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supercede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms.

2.07 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Microsoft Edge™ or Mozilla Firefox™.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface.
- D. The Web browser client shall support at a minimum, the following functions:
 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
 2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
 3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
 4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine.
 5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
 6. User's shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - 1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

- 2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - c. View logs and charts
 - d. View and acknowledge alarms
 - e. Setup and execute SQL queries on log and archive information
7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.08 SERVER FUNCTIONS AND HARDWARE

- A. A central server, located Facility Services, shall be provided. The server shall support all Network Area Controllers (NAC) connected to the Universities network whether local or remote.
- B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, or T1 connection.
- C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from the Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.
- D. The server shall provide the following functions, at a minimum:
 1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
 2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
 3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
 4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
 5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
 6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
 7. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

8. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
 - a. Routing of alarms to display, printer, email and pagers
 - b. View and acknowledge of alarms
 - c. Query alarm logs based on user-defined parameters
9. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
 - a. Viewing and printing log data
 - b. Exporting log data to other software applications
 - c. Query log data based on user-defined parameters

2.09 SYSTEM PROGRAMMING

- A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display.
- C. Programming Methods:
 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons.
 3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
 4. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

D. LonWorks Network Management:

1. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.
2. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
3. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
4. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
5. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system shall not be accepted.

2.10 DYNAMIC ANIMATED COLOR GRAPHIC DISPLAYS

- A. The Temperature Controls Contractor shall update existing graphics software to include the new equipment and control points required for this project.
- B. Color graphic floor plan displays, and system schematics for each piece of mechanical equipment (including air handling units, variable air volume boxes, fan coils, unit ventilators, cabinet heaters, exhaust fans, fin tube radiation, chilled water systems, hot water boiler systems, and so forth as required) shall be provided, as specified in the point list portion of this Specification, in order to optimize system performance analysis, speed alarm recognition, and simplify user interaction. The Temperature Controls Contractor shall fully configure the color graphics and plot all associated control/monitoring points on the screen. Copies of all color graphics screens shall be provided as color printouts to the engineer for approval.
- C. **System Selection/Penetration:**
 1. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands. Floor plans shall display room numbers and each temperature control zone shall be color-coded to identify the floor plan area served by each zone. The operator shall be able to point and click on a room or zone of rooms (in the case of an air handler that serves more than one zone). The room or zone will display an animated flow diagram of the mechanical equipment that serves that zone, with all control and monitoring points associated with that piece of equipment, including setpoints. Setpoints shall be overridden or modified from this screen.
- D. **Dynamic Animated Data Displays:**

1. Dynamic temperature values, humidity values, flow values, and status indication shall be shown in their actual respective locations, and shall automatically update to represent current conditions without operator intervention. Damper and valve positions, air and water flow shall be animated and shall represent actual, current conditions.
- E. System Performance Analysis Screens:
1. System performance analysis screens shall be provided for the major mechanical systems (such as air handlers, chillers, boilers, and so forth.). For each of these systems, the screen shall simultaneously display multiple view ports with the following (minimum) data:
 - a. Dynamic animated flow diagrams.
 - b. Text sequence of operations from engineering as-built submittals.
 - c. Space temperature summaries from each zone being served by mechanical system.
- F. Windowing:
1. The windowing environment of the GUI shall allow the user to simultaneously view several graphics at the same time to analyze total building operation, or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
- G. Alarm Annunciation:
1. Any point in a state of alarm shall indicate such via flashing or color changing graphical display, until it is no longer in alarm.

2.11 OBJECT LIBRARIES

- A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- D. The library shall include applications or objects for the following functions, at a minimum.
- E. Scheduling Object:
 1. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.

F. Calendar Object:

1. The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.

G. Duty Cycling Object:

1. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals.

H. Temperature Override Object:

1. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.

I. Start-Stop Time Optimization Object:

1. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.

J. Demand Limiting Object:

1. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.
2. The library shall include control objects for the following functions.

K. Analog Input Object:

1. Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay

filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.

L. Analog Output Object:

1. Minimum requirement is to comply with the BACnet standard for data sharing.

M. Binary Input Object:

1. Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.

N. Binary Output Object:

1. Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum.

O. PID Control Loop Object:

1. Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.

P. Comparison Object:

1. Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

Q. Math Object:

1. Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

R. Custom Programming Objects:

1. Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.

S. Interlock Object:

1. Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

T. Temperature Override Object:

1. Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

U. Composite Object:

1. Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.
2. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software.

V. BACnet Devices:

1. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide BACnet manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the BACnet profile shall be supported. Information (type and function) regarding network variables not defined in the BACnet profile shall be provided by the device manufacturer.
2. For devices not conforming to the BACnet standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

2.12 FIELD BUS COMMUNICATIONS

- A. All communications shall be via twisted pairs wires, shielded where required and approved for use with system.
- B. UCs and intelligent actuators and sensors shall reside directly on a peer-to-peer network.

2.13 GRAPHICAL USER INTERFACE (GUI) TERMINAL (WORKSTATION)

- A. The personal computer shall be an Intel Pentium based computer (minimum processing speed of 2.4 GHz with 512 MB RAM and an 160-gigabyte minimum hard drive). It shall include a 16X CD/DVD burner (DVD+/-RW), 1-serial port and 4-(minimum) USB ports. It shall contain the network interface cards required (10/100/1000 Ethernet). An optical 2-button scroll mouse and a minimum 22 inch widescreen flat panel monitor with screen resolution of up to 1680x1050 pixels (minimum) and 5ms (minimum) response time.
- B. A system printer shall be provided. Printer shall be laser type with a minimum 600 x 600-dpi resolution and rated for 15-PPM print speed minimum.
- C. Provide prefabricated metal frame nominal 24" x 30" mobile cart designed for personal computers.
- D. The GUI shall employ browser-like functionality for ease of navigating through the operating system, see "OPERATING SYSTEM (OS)" and "SYSTEM PROGRAMMING." It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification. Display of information shall be in real time.

2.14 OTHER CONTROL SYSTEM HARDWARE

- A. Dampers:
 - 1. Any automatic control dampers not specified to be integral with other equipment. Frames shall be not less than 2 inches wide and shall not be less than 13-gauge galvanized steel. Blades shall not be over 8 inches wide nor less than 16-gauge galvanized steel roll formed. Bearings shall be oilite, ball-bearing or nylon with steel shafts. Side seals shall be stainless steel of the tight-seal spring type. Dampers shall have neoprene blade edge and side seals. Dampers and seals shall be suitable for temperature ranges of -40 to 200°F.
 - 2. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types.
 - 3. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6" in any dimension.
 - 4. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all control dampers with the temperature control submittal. Maximum leakage for dampers in excess of sixteen inches square shall be 30 CFM per square foot at static pressure of 1 inch of WC.
 - 5. Where ultra-low leakage dampers are specified the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 4 CFM per square foot for dampers in excess of sixteen inches square at 1 inch of WC.
- B. Actuators:
 - 1. All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with actuators sized to operate their appropriate loads with sufficient

reserve power to provide smooth modulating action or two-position action and tight close-off. Actuators shall be spring return type where valves or dampers are required to fail to a safe position.

- C. VAV Terminal or Unitary Controller Space Temperature Wall Modules (Thermostats): Wall modules shall be provided where shown on plans and shall be mounted 48" above finished floor. Temperature sensors shall be Resistance Temperature Detector (RTD) type of 100, 1000, or 3,000 ohm platinum, 500 ohm BALCO, or 20,000 ohm. Each room (thermostat) sensor shall provide temperature indication to the associated controller. Plastic enclosures (including sub-base) shall be UL94-5V rated. Sensor shall be accurate $\pm 0.75^{\circ}\text{F}$ within a range of 40-100°F. Each Space Temperature Wall Module shall contain:
1. Manual occupied/unoccupied override switch with visual indication of both occupied and unoccupied override modes.
 2. Manual setpoint adjustment with the capability for a software-limited set point minimum and maximum values.
 3. A relative set-point indication scale for visual indication.
 4. A wiring port for connection of a portable operator's terminal.
- D. Duct Mounted, Pipe Mounted and Outside Air Temperature Sensors:
1. Provide thermistor temperature sensors with an accuracy of $\pm 0.2^{\circ}\text{C}$. Outside air sensors shall include an integral sun shield. For insertion type water piping sensors, provide brass wells of sufficient size for the piping and sensors installed.
 2. Outdoor Air Temperature Sensors: Sensors shall contain an RTD sensing element mounting in an enclosure rated for outdoor use. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.
- E. Relative Humidity Sensors:
1. Duct mounted relative humidity sensors shall be provided with sampling chamber and shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 4\%$ over the range of 10 to 80% RH. Wall Mounted (Space) Relative Humidity Sensors shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 3\%$ over the range of 20 to 60% RH. Outside Air Relative Humidity Sensor shall have outside weather enclosure and shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 2\%$ over the range 20 to 90% RH. Humidity sensors to be installed adjacent to space temperature wall modules (thermostats) may be an integral component of the space temperature wall module in lieu of a separate wall mounted device.
- F. Current Sensitive Switches:
1. Solid state, split core current switch that operates when the current level sensed by the internal current transformer exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

G. Differential Pressure Transducer:

1. Transducer shall be for air or water service. The device shall output a 4-20 milliamp signal which is linear in relation to the sensed pressure. Accuracy shall be $\pm .01\%$ of full scale. The power shall be from the controller and shall be in the range of 22-26 volts DC. The unit shall have temperature compensation so that thermal effects are no more than $\pm .05\%$ of the full scale from 32-100°F. The transducer shall be suitable for the media and pressure measured.

H. Differential Pressure Switch (Air):

1. Switch shall have a single-pole, single-throw (SPST) contact, adjustable setpoint, UL rated 9.8 amperes at 120 volts.

I. Differential Pressure Switch (Water):

1. Switch shall have a single-pole, single-throw (SPST) contact, adjustable setpoint, UL rated 6 amperes at 120 volts, 100 psig design, with automatic reset. Each switch shall be provided with isolation and drain valves. Except where indicated otherwise in this Specification or where flow switches are provided by equipment manufacturer, provide differential pressure switch in the piping to/from each chiller and boiler to prevent operation of each of these units if flow is not proven.

J. Carbon Dioxide Sensors:

1. Sensors shall be TSI, INC. 8700 Series, or equal, wall mounted non-dispersive infrared carbon dioxide sensor. The diffusion gas sample chamber shall be surrounded by a semi-permeable membrane and an electronically pulsed infrared source with no moving parts. The sensor shall have a carbon dioxide measurement range of 0-2,000 ppm, with an accuracy of 25 ppm. The sensor shall have a linear output of 0-10VDC or 2-20mA and shall be Echelon (BACnet) interoperable. Include all accessories required for complete installation.

K. Occupancy Sensors:

1. Sensor Switch CM-PDT Series, or equal, low voltage ceiling mounted sensor, complete with power supply, isolated relay and all accessories required for the application. Sensor shall have adjustable time delay and 360 degree coverage.

L. Power Monitoring Interface:

1. The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UI-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BMCS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output values shall be hard-wired inputs to the BMCS or shall be communicated to the BMCS over the LAN.

M. Air Flow Control Modules:

1. Air Flow Control Modules (AFCM) shall be capable of direct measurement of airflow through an outside air inlet and produce dual outputs; one representing the measured airflow, and the other to control the inlet damper.
2. Air Flow Control Modules shall contain an integral multi-line liquid crystal display for use during the configuration and calibration processes. All configuration, output scaling, calibration, and controller tuning will be performed digitally in the on-board microprocessor via input pushbuttons.
3. Air Flow Control Modules shall measure inlet airflow with an accuracy of $\pm 5\%$ of reading over a range of 150-600 FPM, 250-1,000 FPM, 150-2,000 FPM, and 500-2,000 FPM and not have its reading affected by the presence of directional or gusting wind. Measured airflow shall be density corrected for ambient temperature variances, and atmospheric pressure due to site altitude.
4. Air Flow Control Modules shall interface with the building automation systems (BMCS), accepting inputs for fan system start and an external controller setpoint, and provide flow deviation alarm outputs.
5. The sensors shall be constructed of materials that resist corrosion due to the presence of salt or chemicals in the air; all non-painted surfaces shall be constructed of stainless steel. Sensors shall be factory mounted in an airflow station constructed of a 14 ga. galvanized steel, 6" deep welding casing with 90° connecting flanges and a galvanized expanded metal sheet. The electronics enclosure shall be NEMA 1
6. Air Flow Control Modules shall be the VOLU-flo/OAM Station as manufactured by Air Monitor Corporation, Santa Rosa, California complete with a factory mounted (Greenheck VCD-33) control damper. Outside Air Flow Control Modules may be Johnson Controls Incorporated AD-1250 series, or Ruskin AMS050 series with integral 1/2" honeycomb air flow straighteners and control damper.
7. The control dampers shall consist of a 16 ga galvanized steel channel frame with 5 in depth; airfoil shaped, galvanized steel double skin construction blades (14 ga equivalent thickness); blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow in either direction or pressure on either side of the damper; 0.5 in dia. plated steel axles turning in synthetic (acetal) sleeve bearings; extruded silicone rubber blade seals for 300 F maximum temperature; 304 SS flexible jamb seals; and external (out of the airstream) blade-to-blade linkage.
8. Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval showing damper suitable for pressures to 8 in wg, velocities to 4,000 ft/min and temperatures to 180 F. Testing and ratings to be in accordance with AMCA Standard 500.

N. DDC Control Panel Enclosures:

1. Except for DDC controllers factory installed within control compartments of equipment, furnish control panel enclosures of Code gauge steel with locking doors for mounting all DDC controllers. Control panels shall meet all requirements of Title 24, California Administrative Code. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of "as-built" control drawings (relating to the controls within the panel) shall be furnished within each control panel. Labels shall have full length pin hinge door with keyed lock. Provide two keys for each lock.

O. Low Limit Thermostats:

1. Low limit thermostat shall be of manual reset type, with setpoint adjustment. The sensing element shall be 20 foot minimum and shall be installed completely across the coil. When any one foot of the element senses a temperature as low as the setpoint, the thermostat contacts shall open. These shall contain double pole switches for simultaneous remote alarms or as desired.

P. Firestats:

1. Furnish in the inlet air stream of each recirculating air moving device a manual reset thermostat to turn off the fans if the inlet temperature exceeds 125°F. Thermostat shall be UL listed or Factory Mutual approved for the service intended. Where duct mounted smoke detectors are provided to automatically shut down the air moving device (see below), fire protection thermostats may be deleted.

Q. Smoke Detectors:

1. Duct mounted smoke detectors shall be provided and connected to the building fire (alarm) detection system under Division 28. Coordinate detector location and coordinate fan shutdown sequence as specified in the Sequence of Operations. HVAC control wiring between the fire detection system interface device and the air system controls shall be by the Temperature Controls Contractor.

R. Miscellaneous:

1. On/Off Control: Equipment on/off control shall use either momentary pulsed relays or magnetically latched relays, as appropriate for the equipment's control starter. Hand-off-auto switches or parallel on/off pushbuttons shall be provided where required to permit local override of the BMCS.
2. On/Off Status: Equipment on/off status sensing shall use positive proof of flow devices. Pumps shall have current sensing relays, and air units shall have differential pressure flow switches, or current sensing relays.
3. Interfaces: Analog setpoint control shall use an electric output signal to adjust the setpoint position of the local control loop equipment. Interfacing controls shall be configured such that loss of communications with the BMCS shall cause the setpoint controller to remain at its last commanded value.

PART 3 - EXECUTION

3.01 GENERAL

- A. The BMCS shall be designed, installed, and commissioned in a turnkey operational manner. Include all labor and materials required for a complete installation.
- B. Where control devices are installed on insulated piping or ductwork, provide standoff brackets or thermowells sized to clear insulation thickness. Provide extended sensing elements, actuator linkages, and other accessories as required. Wells shall be by the Temperature Controls Contractor and installed by the Piping Contractor.
- C. Provide conduit, wiring, tubing and required hardware to interface the following points onto the BMCS:

D. Variable Air Volume (VAV) Air Handling Units (Each Unit):

1. Return Air Temperature and Humidity
2. Discharge Air Temperature and Humidity
3. Mixed Air Temperature and Humidity
4. Fan Start/Stop
5. Fan Status
6. Return Air Control Damper Position
7. Outside Air Control Damper(s) Position
8. Minimum O.A. Flow Control Module CFM
9. Static Pressure Input
10. Fan Speed Control

E. Constant Volume Air Handling Units/Fan Coil Units (Each Unit):

1. Space Temperature and Humidity (Wall Module)
2. Return Air Temperature and Humidity
3. Discharge Air Temperature and Humidity
4. Fan Start/Stop
5. Fan Status
6. Outside Air Damper Position

F. VAV Terminal Boxes (Each Box):

1. Damper Motor Control/Position
2. Velocity probe for CFM measurement
3. Heating/Minimum/Maximum CFM Setpoint
4. Discharge Temperature Sensor
5. Space Temperature (Wall Module)
6. Heating Control (Where Applicable)
7. Occupancy Sensor (Where Applicable, See Equipment Schedule on Drawings)

G. Exhaust Fans:

1. Start/Stop, Each Fan
2. Run Status, Each Fan
3. VFD Status, Each Fan

H. General:

1. Outside Air Temp
2. Outside Air Humidity
3. Fire Alarm General Alarm
4. Domestic Water Circulator Pump Start/Stop

- I. Provide additional I/O devices, etc., as required for control sequences as described hereinafter. Provide hardware, software and programming as required.

3.02 SEQUENCES - VARIABLE AIR VOLUME (VAV) AIR HANDLING UNITS (RTU-1, 2, 3)

- A. VAV air handling unit shall be controlled by the unit's local DDC panel. Unit shall be started by local DDC panel through HOA switch mounted in cover of air unit starter. Current sensing relays shall indicate unit run status, and shall set automatic controls in operation.

- B. High limit thermostat in return air shall stop unit upon detection of temperature above its setpoint. Electric low limit thermostat, upstream of the cooling coil, shall stop unit upon detection of temperature below its setpoint. A manual reset static pressure high limit in discharge of fan shall stop unit upon detection of pressure above its setpoint.
- C. Air handling unit shall be disabled upon detection of products of combustion by the duct mounted smoke detector(s) and/or an alarm signal from the building Fire Detection System, See Division 28.
- D. A sensor in cooling coil discharge and a sensor in the return air, shall transmit temperature and humidity changes to the DDC panel, which shall modulate the compressors and electric heating coil in sequence to maintain the necessary discharge temperature and cooling coil apparatus dewpoint for proper moisture removal. A humidity sensor in the return air shall transmit humidity changes to the DDC panel. Provided that return air humidity does not exceed high limit setpoint (initially set for 53%), discharge air setpoint shall be reset inversely to return air temperature. Initially, as return air changes from 78°F to 70°F, discharge air changes from 55°F to 60°F (adjustable). The temperature and humidity setpoints shall be adjustable through the BMCS.
- E. The supply fan speed shall modulate to maintain the discharge static pressure setpoint (adjustable), as determined from the duct static pressure sensor at a location near the end of the dominant duct main. Where the layout of the primary supply air distribution duct system is such that there is no obvious dominant duct main, provide a pressure sensor in each of the two most dominant duct mains, and the setpoint is to be determined from the minimum of the two duct static pressure sensors (at locations near the end of the two most dominant duct mains). The DDC panel shall continually poll the air unit's associated VAV terminals to determine which terminals have their damper in the most open position. The DDC panel shall reset the air unit static pressure so that at least one VAV terminal, the one requiring the highest inlet pressure, is 100% open. The DDC controller will provide a 4-20mA signal to the VFD to vary the fan speed.
- F. Provide for morning warm-up cycle on this unit as follows. Return air sensor shall transmit temperature changes to the local DDC panel. DDC panel shall close outside air damper, fully open return air damper, lockout cooling, lockout exhaust fan(s), open single duct VAV terminal units to maximum CFM, and enable VAV terminal units to operate via local thermostat control until the unit return air temperature reaches its setpoint (adjustable), terminating morning warm-up cycle. Morning warm-up shall be a separate control routine occurring prior to normal occupied mode of operation. Provide for morning cool-down cycle in a similar manner, with heating lock-out.
- G. Provide for space temperature limit control during unoccupied mode. If space temperature falls below 65°F (adjustable), the air unit system shall operate the same as described for morning warm-up cycle. If space temperature rises above 85°F (adjustable), the air unit system shall operate same as described for normal occupied mode, except the outside air damper shall remain closed. This mode of operation shall continue until space temperature is within the 65°F to 85°F temperature limit.
- H. Stopping the unit supply fan shall automatically de-energize the control system. All cooling and heating functions shall be disabled, outside air damper shall close and VAV terminal units shall be disabled. The supply fan control signal shall be modulated to minimum speed in preparation for unit restart.

I. Minimum Outside Air (O.A.) Control

1. For each VAV air handling unit, provide control (in the normal mode of operation) to maintain required minimum O.A. flow rate, regardless of the supply fan air flow rate. Minimum O.A. control shall be maintained by modulating the O.A. damper and Return Air (R.A.) damper in sequence to maintain O.A. setpoint via the direct measurement of O.A. flow rate. In normal mode of operation, the R.A. damper shall be fully open until the point of operation where the O.A. damper is fully open and the R.A. damper must then incrementally close to maintain O.A. setpoint. Outside Air CFM shall be a control feature capable of being monitored by the BMCS, and the Outside Air CFM setpoint shall be fully adjustable. Damper control for both the O.A. damper and the R.A. damper shall be via separate actuators, no mechanically linked O.A./R.A. dampers.
2. The Outside Air Flow Control Module (see "OTHER CONTROL SYSTEM HARDWARE" within this specification section) shall be provided by the Temperature Controls Contractor for field installation in the O.A. ductwork. Select the module so that the air pressure drop through the assembly shall be comparable to that for the return air damper at design air flow rate, but should not exceed 0.11 inch W.C. Generally the face velocity through the O.A. Airflow Measurement Module shall be within the 400 to 1000 FPM range. Provide access doors to properly maintain module.
3. The Outside Air Flow Control Module shall be furnished as an integral component of the Air Handling Unit's (combination) filter mixing box, see "AIR HANDLING UNITS" in Section 230050. The Temperature Controls Contractor shall provide applicable damper actuator(s) on Air Handling Unit's mixing box dampers and all necessary control components for interfacing with the unit's integral Outside Air Flow Control Module.
4. For each VAV unit, provide low temperature limit control of supply air temperature to 50°F by reducing O.A. flowrate and increasing R.A. flowrate to maintain low temperature limit.
5. The Outside Air Flow Control Module (damper) shall be capable of full closure and shall close whenever unit is de-energized.
6. Provide programmable safety limit control to prevent full closure of R.A. damper, set initially to limit at 75% full closure.

3.03 SEQUENCE – SINGLE ZONE VAV AIR HANDLING UNIT (RTU-4,5)

- A. Supply Fan Start/Stop: The unit shall be started and stopped via the unit's local DDC panel through HOA switch in Variable Frequency Drive (VFD). Starting the unit fan shall place automatic control system of the air unit and other associated devices in operation. A current sensing relay shall indicate unit run status. When the supply fan status indicates the fan started, the control sequence shall be enabled.
- B. Minimum Outside Air / Demand Based Ventilation Control:
 1. General: When in occupied mode, the Outside Air (OA) shall be measured and controlled to maintain ventilation and pressurization requirements.
 - a. An OA Flow Control Module (consisting of an assembly featuring direct measurement of airflow plus damper control of flow rate) shall be provided to continuously monitor the outside air volume flow rate (in CFM) and send an output signal to the BMCS to maintain OA cfm setpoint as system fans modulates. OA cfm input and output plus OA damper position feedback shall be monitored and graphically displayed in the BMCS.

- b. The OA Flow Control Module shall be furnished as part of the Temperature Controls scope of work, for field installation in the OA ductwork at the air unit's mixing box inlet duct connection.
 - c. Provide separate modulating actuators and analog I/O for OA Flow Control Module and return damper.
 - d. OA Flow Control Module must be sized for a minimum of 200 fpm at absolute minimum OA flow rate for proper control.
 - 2. Startup sequence: Upon startup, open the return damper 100% and the OA damper to minimum position.
 - a. When the unit is started in occupied mode and OA temperature is less than 40°F (adj.), the outside air (OA) damper shall ramp open to its minimum setpoint over a 5 minute (adj.) period. When OA temperature is greater than 40°F, there shall not be a delayed ramp open period.
 - 3. When switching from unoccupied to occupied mode, the outside air damper shall initially open to obtain absolute minimum OA cfm setpoint. The failsafe operating condition for the demand based ventilation sequence shall maintain normal design OA cfm setpoint as scheduled.
 - 4. The mixed air temperature shall limit the OA damper/and return damper positions to maintain a predetermined MAT minimum value (adj., initially set at 50°F).
 - 5. In the unoccupied mode, the return damper shall go full open, OA damper shall remain closed.
- C. Space Temperature Control:
- 1. Zone Temperature Control (via sequenced DAT reset and fan speed control): The unit DDC panel shall use zone temperature to automatically select heating or cooling mode. Both cooling and heating setpoints shall be adjustable from the wall module (zone thermostat), but local setpoint shall have programmable High/Low temperature control limits (initially 78°F/68°F). Heating and cooling demand shall be calculated through independent heating and cooling PID outputs. These PIDs shall have individually adjustable interval, bias, and proportional, integral and, derivative parameters carefully tuned in each application for slow action to avoid hunting, particularly of fan speed drives. The discharge air temperature shall first be reset depending on zone heating or cooling demand with fan operating at minimum airflow/speed. Then supply air fan will modulate through its minimum and maximum speed range to maintain the zone temperature setpoint as described below.
 - a. Heating Mode: When zone temperature drops below heating setpoint (with 0.5°F (adj) hysteresis), unit control shall be indexed to Heating Mode and cooling shall be disabled.
 - 1) First Stage - Heating DAT reset: Heating PID output from 1 to 20% (adj.) shall first reset DAT from minimum 68°F (adj.) to maximum of 87°F Deg.F (adj.) while supply air flow stays at minimum ventilation cfm / fan speed setpoint.
 - 2) Second stage – Increase Airflow: Upon continued zone temperature below setpoint, Heating PID output increasing from 21-100% shall increase supply airflow setpoint from min to max cfm (adj.).
 - 3) Reverse shall occur as zone temperature rises above heating setpoint, with hysteresis.

- 4) When outdoor temperature falls below 40°F, unit controls shall incrementally reset supply airflow setpoint in order to maintain a predetermined MAT minimum value (adj., initially set at 53°F).
- b. Deadband: When zone temperature is within deadband (allowing for cooling and heating mode hysteresis), unit controls shall revert to demand based ventilation control mode to maintain minimum ventilation. DAT shall remain in control from last mode, and fan shall modulate down to minimum airflow setpoint/speed to achieve minimum ventilation setpoint.
 - c. Cooling Mode: When zone temperature rises above cooling setpoint (with 0.5°F (adj) hysteresis), unit control shall be indexed to Cooling Mode and heating shall be disabled.
 - 1) First Stage – Cooling DAT reset: Cooling PID output from 1 to 20% (adj.) shall first reset DAT from maximum 74°F (adj.) to minimum of 52°F (adj.) while supply air flow stays at minimum ventilation cfm / fan speed setpoint.
 - 2) Second stage – Increase Airflow: Upon continued zone temperature above setpoint Cooling PID output increasing from 21-100%), increase supply airflow setpoint from min to max cfm (adj.).
 - 3) Reverse shall occur as zone temperature drops below cooling setpoint, with hysteresis.
 - d. Unoccupied mode: Unit shall cycle between off- heat/cool modes during unoccupied periods while allowing for wider temperature offset ranges above and below unoccupied setpoints. The intent is to allow the associated air handling unit(s) not to have to run continuously during the normally unoccupied period but rather cycle only as needed to keep associated zone within an acceptable temperature range.
 - 1) Apply +/- 3 degree (adjustable) allowable "drift" from unoccupied heating and cooling setpoints as described below.
 - 2) Cooling: The zone would not generate a cooling request to run unit until the zone temperature drifts 3 degrees above its unoccupied setpoint. At that point, the unit shall be enabled and shall ramp up in sequence to 100% cooling demand as described above until space drifts 3 degrees below unoccupied space temperature setpoint. Then zone controller shall have no run request, reverse sequence and turn unit off until cycle repeats.
 - 3) Heating: A zone would not generate a heating request to run unit until the zone temperature has drifted 3 degrees below its unoccupied setpoint. At that point, the unit shall be enabled and ramp up in sequence to 100% heating output as described above until space drifts 3 degrees above unoccupied space temperature setpoint. Then zone controller shall have no run request, reverse sequence and unit would return to off until cycle repeats.
 - 4) An inhibit feature on the timed override control shall be included which shall prevent sending cooling or heating requests and/or otherwise enabling associated AHU if zone temperature is within +/-3°F (adj.) of last previous occupied cooling/heating setpoints respectively when local override button is activated.

- e. De-humidification Control: Provide de-humidification control such that upon a rise in return air humidity above the setpoint, the DDC panel shall modulate the cooling coil to 100% and the hot-gas re-heat coil valve shall be modulated for temperature control. Include programmable limit such that space temperature cannot exceed 2°F greater than the space temperature setpoint during de-humidification (reheat mode). Upon a call for dehumidification, the electric heating coil shall be disabled. The dehumidification sequence shall be disabled anytime the outdoor air temperature is below 55°F. The dehumidification sequence shall end when the return relative humidity falls below 4% of the high return humidity setpoint.
- f. Unit Shutdown: Stopping the unit supply fan shall automatically de-energize the control system. All cooling and heating functions shall stop. The return damper shall go full open, and OA damper shall close.
- g. Safeties: Air unit shall be disabled upon detection of products of combustion by the duct mounted smoke detector(s) and/or an alarm signal from the building Fire Detection System, See Division 28. High limit thermostat in return air shall stop unit upon detection of temperature above its setpoint. Electric low limit thermostat in the mixed air shall stop unit and the makeup air unit upon detection of temperature below its setpoint.

3.04 SEQUENCES - SINGLE DUCT VAV TERMINAL UNITS

- A. Variable air volume terminal units shall be controlled by DDC VAV terminal unit controllers.
- B. A wall mounted module (thermostat), located where indicated, shall transmit temperature changes to the terminal unit DDC controller. Unless indicated otherwise, space temperature setpoint shall be adjustable from the wall module (thermostat), but local setpoint shall have programmable high/low temperature control limit (initially set 72°F/68°F). When pressed, an override button integral to the wall module (thermostat) shall place the system in operation for a programmable (three hours initially) time period.
- C. On a drop in room temperature below setpoint, the terminal unit shall modulate from a maximum cooling air flow to minimum cooling air flow. On a further drop, the terminal unit shall increase the air flow to the re-heat air flow setpoint and the SCR electric heating shall be modulated to maintain space conditions. Heating discharge air shall not exceed 87°F in heating mode and 72°F in reheat mode. Reheat mode shall operate when space temperature drops 2 degrees below setpoint, after that heating mode shall engage. On a rise in room temperature, the reverse shall occur.

3.05 SEQUENCES - EXHAUST FANS

- A. Except during morning warm-up (see "Sequences - VAV Air Handling Units") starting any air handling unit shall start the exhaust fan(s) associated with the floor served by the air handling unit. When all air handling units are stopped, the exhaust fan shall stop.

3.06 INTERLOCKING - MISCELLANEOUS

- A. All electrical interlocking shall be done by the Temperature Controls Contractor. The Temperature Controls Contractor shall furnish all switches and other devices necessary to accomplish the interlocking specified herein and shall furnish to the Architect for approval a digital copy (PDF format) of all wiring diagrams necessary to accomplish the interlocking.

- B. Provide a switch for each air unit at the location shown on Drawings. Switches shall have ON-OFF position. In OFF position, air units shall be off and valves closed to coils. In ON position, all units and unit controls shall be energized.
- C. At each air unit switch position, provide a manual override switch that will override the setting of the BMCS and energize all controls required so that the air unit and all associated terminal boxes and controls shall operate. Provide (programmable) 6 hour timed override capacity.
- D. Interlock VAV terminal boxes with the air handling unit serving the boxes such that the boxes are de-energized when the air unit is de-energized.

3.07 SUBMITTALS

- A. Provide a digital copy (PDF format) of submittal data within 90 days of contract award.
- B. Submittal shall consist of:
 - 1. System architecture showing all digital devices, computers and network configuration.
 - 2. Equipment lists of all proposed devices and equipment including data sheets of all products.
 - 3. Valve, damper, and well and tap schedules showing size, configuration, capacity and location of all equipment.
 - 4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480 character alarm message. All text shall be approved prior to data entry.
 - 5. Schematic device wiring and piping interconnection diagrams including panel and device power and sources.
 - 6. Software design data including flowchart of a typical DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.
 - 7. Detailed description of system operation.
 - 8. Include complete list of all points monitored.
 - 9. Provide sequence of operation for all equipment.

3.08 INSTALLATION

- A. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All piping and wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the Electrical Specification, Division 26. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system. Where allowed, wiring not installed in conduit shall be plenum rated.

- B. The Temperature Controls Contractor shall enter all computer data into the related computers including all control programs, initial approved parameters and settings, graphics, and English descriptors.
- C. Tagging: Identify all cables at each end and at crowded intermediate points by means of stamped, non-ferrous tags, clipped around each cable.
- D. Install panels and controllers within a dedicated metal enclosure.
- E. Room Thermostats: All thermostats shall be mounted so that the top of the thermostat is 48" above the floor and aligned with the top of the light switch plates and 8" from the light switch if shown on the Drawings adjacent to the light switch. Room thermostat locations shall be coordinated with door swings, light switches and other wall mounted items. Label each thermostat to match tagging of equipment served; labels shall be generated by commercial electronic label makers utilizing self-adhesive flexible laminated tapes.

3.09 ACCEPTANCE

- A. The Temperature Controls Contractor shall completely check out, calibrate and test all connected hardware and software to ensure that the system performs in accordance with the approved specifications and sequences of operations approved.
- B. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs.
- C. The Temperature Controls Contractor shall furnish a portable UC programming tool with preloaded software and necessary interface cable to the balancing contractor for use during system balancing. The balancing contractor shall be responsible for proper use and care of this tool, and shall return it to the Temperature Controls Contractor immediately upon balancing completion. The Temperature Controls Contractor shall provide the balancing contractor up to four hours training on the use of this tool in order to exercise actuators and enter calibration and balancing parameters. Additional training or assistance required by the balancing contractor shall be contracted directly with the Temperature Controls Contractor by the balancing contractor.

3.10 DOCUMENTATION

- A. Two Operators Manuals and two (As-Built) Record Drawing Manuals shall be provided to the Owner. Digital copies (PDF format) to be provide on CD-ROM or USB flash disk.
- B. The Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.
- C. CD-ROM or USB flash disk with all AutoCAD or Visio drawings, and configuration data files including all point processing assignments, physical terminal relationships, scales and offsets, command and alarm limits, graphics, etc.
- D. The record drawing manuals shall include all materials required under the paragraph "SUBMITTALS" on this Specification, updated/corrected to show as-built condition change orders, field modifications, etc.

- E. Software: The Temperature Controls Contractor shall maintain two CD-ROMs or USB flash disks with all graphics, data files and application programs for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training sessions, and one copy shall be archived in the Temperature Controls Contractor's local software vault.

3.11 TRAINING

- A. All training shall be by the Temperature Controls Contractor and shall utilize operators' manuals and as-built documentation.
- B. Operator training shall include two eight-hour sessions encompassing modifying text and graphics, sequence of operation review, selection of all displays and reports, use of Portable Operators Terminals, troubleshooting of sensors (determining bad sensors), and password assignment and modification.
- C. One training session shall be conducted at system completion, and the other shall be conducted forty five days after system completion.
- D. Temperature Controls Contractor shall provide Owner signed completion forms for both training sessions.

END OF SECTION

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. The requirements contained in this Section apply to all Sections of this Division.
- B. Section Includes:
 - 1. Common terminology and requirements used throughout this Division.
 - 2. Requirements for Acceptance Testing Agency.
 - 3. Requirements for Professional Engineers responsible for Delegated Design.
 - 4. Electrical equipment coordination and installation.
 - 5. Common electrical installation requirements.

1.2 DEFINITIONS

- A. AHJ: Authorities Having Jurisdiction.
- B. ANSI GRAY: Where this Section and other Sections of this Division use the term "ANSI GRAY" it shall mean the manufacturer's standard ANSI Gray.
- C. Bound Material: Bound refers to materials permanently bound, as by stitching or glue, or materials securely fastened in their covers by multiple fasteners that penetrate all papers. Ring binders, spiral binders, brads and screw posts are acceptable fasteners. Loose papers clipped together or stapled at one corner are not acceptable.
- D. Business Day: Where this Section and other Sections of this Division use the term "Business Day" it shall mean Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.
- E. EPDM: Ethylene-propylene-diene terpolymer rubber.
- F. FMS: Facility management system.
- G. NETA ATS: Acceptance Testing Specification, as published by International Electrical Testing Association.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. NIST: National Institute of Science and Technology.
- J. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.
- K. RS-485: A TIA standard for multipoint communications using two twisted-pairs.

- L. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

1.3 PERFORMANCE REQUIREMENTS

- A. The Drawings diagrammatically show the sizes and locations of various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the Work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the Work. In cooperation with other trades, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner, without additional cost to the Owner.

1.4 SUBMITTALS

- A. Refer to Division 1 for Submittal Requirements.
- B. Submittals Required: Refer to Division 26 Sections for submittals required. Provide complete submittals where required. Required submittals include but are not limited to the following
 - Lighting Fixtures - Manufacturer's Product Data
 - Lighting Controls - Manufacturer's Product Data and Shop Drawings
 - Panelboards - Manufacturer's Product Data and Shop Drawings
 - Switchboards - Manufacturer's Product Data and Shop Drawings
 - Electrical/Data Room Layouts - Dimensioned Drawings of Elec/Data Rms w/ equip.
 - Transformers - Manufacturer's Product Data and Shop Drawings
 - System Studies - Overcurrent Protective Device Coordination Study
 - Wiring Devices - Manufacturer's Product Data
 - Enclosed Switches and Circuit Breakers - Manufacturer's Product Data
 - Lightning Protection System - Manufacturer's Product Data and Shop Drawings
 - Data Cabling and Data Room Equipment - Manufacturer's Product Data
 - Nurse Call - Manufacturer's Product Data and Shop Drawings
 - Speakers - Manufacturer's Product Data and Shop Drawings
 - Fire Alarm - Manufacturer's Product Data and Shop Drawings
 - Access Control Equipment - Manufacturer's Product Data
- C. Corrections or comments made on submittals during review shall not relieve the Contractor from compliance with requirements of the contract documents. Submittals will be checked for general conformance with the design concept of the project and general compliance with information given in the contract documents. Review of Shop Drawings or other submittals shall not relieve the

Contractor from responsibility for confirming and correlating all quantities and dimensions, coordinating work with that of all other trades, and performing work in a safe and satisfactory manner. Review of shop Drawings or other submittals shall not permit any deviation from Drawings and Specifications.

1.5 SUBMITTAL PROCEDURES

A. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.
4. Prior to start of project, contractor shall submit a submittal schedule including dates submittals will be sent in for review. Do not send more than one submittal on any given day (submittals shall be sent in staggered intervals).

B. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/8-inch equals one foot.

C. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.

2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/8-inch equals one foot.

D. Common Requirements For Qualification Data:

1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of registration in the Project location.
2. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Prepare drawings showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Electrical Equipment Layouts: Floor plans, elevations, and other necessary details showing dimensioned layouts for spaces containing electrical equipment. Base electrical equipment dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:
 - a. Electrical equipment layout and relationships between components and adjacent structural and mechanical elements.
 - b. Indication of required working clearances and required area above and around electrical equipment where pipes and ducts are prohibited.
 - c. Location of Conduit entry into electrical equipment.
 - d. Location of luminaires, sprinkler piping and heads, ducts, and diffusers.
 - e. Electrical equipment support locations, type of support, and weight on each support.
 - f. Location of structural supports for structure-supported raceways.
 - g. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.

- A. Common Requirements for Independent Testing and Inspecting Agency Qualifications: Where this Section and other Sections of this Division call for an Independent Testing and Inspecting Agency (Testing Agency); the Testing Agency shall comply with the following requirements:
1. Have the experience and capability to conduct the testing indicated,
 2. Be a member company of the InterNational Electrical Testing Association (NETA) or a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction and the Engineer-of-Record.
 3. Meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:
 - a. Be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
 - b. Use technicians who are regularly employed for testing services.
 - c. Have a "Full Membership" classification issued by the InterNational Electrical Testing Association meets the above criteria.
 4. Testing Agency's Field Personnel: Technicians performing specified electrical tests and inspections shall meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:
 - a. Technicians performing specified electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
 - b. Technicians shall be certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing.
- B. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.
- C. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. Perform the following:
1. Promptly notify the Architect in writing of any such difference.
 2. Obtain approval from Architect before proceeding with the Work.
 3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.

- D. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:
 - 1. Promptly notify the Architect in writing of any such difference.
 - 2. Obtain approval from Architect before proceeding with the Work.
- E. 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.
 - 1. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided shall meet the requirements of the UL standard.

1.8 PRODUCT SUBSTITUTIONS

- A. Comply with provisions of Division 01 Section "Product Substitution Procedures".
 - 1. If items of equipment or device offered as Substitution differ in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
 - 2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

1.9 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving large equipment into place. Where any piece of equipment is too large for ingress through normal building openings it shall be placed in its containing space before the enclosing structure is completed.
- B. Temporary Power: Where temporary power is required during the construction period, obtain from Owner facilities. Prior to installation of temporary power, provide written documentation of location temporary power shall be obtained from for Owner approval.

1.10 COORDINATION

- A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items.

Also, where the description is general in nature, the exact sizes, duties, space arrangements, horsepower and other requirements must be obtained by reference to other portions of Contract Documents.

- B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.
- C. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping, ductwork and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- E. Utility Service Coordination:
 - 1. Electrical Service: Electrical service will be obtained from Entergy.
 - 2. Coordinate electrical work with Entergy. Comply with requirements of Entergy regarding connection to new building. Provide all pull boxes, conduits, and all other installations required by Entergy and as required for a complete service installation.
 - 3. Electrical contractor shall set a meeting on site prior to start of any site work with Entergy and electrical engineer to discuss logistics/coordination of new electrical service.
- F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- G. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- H. For roof-mounted equipment: Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- I. Prior to start of any site work, electrical contractor shall call LA OneCall, 811, as required for existing utility markings. No excavation of existing surfaces shall commence prior to the marking of utilities. Contractor shall be responsible for any and all damages that occur due to damage to any underground utilities and circuiting.

1.11 PHASED CONSTRUCTION; SCHEDULING:

- A. Refer to Division 1 for determination of how construction phasing and sequencing may affect performance of electrical work.
- B. Perform work in accordance with sequences shown on drawings and/or as necessary to maintain continuity of electrical service to adjacent areas within the building.
- C. Provide temporary power and data as required to accommodate all phasing requirements. Coordinate on site with engineer when applicable.

1.12 RECORD DRAWINGS:

- A. Except where otherwise indicated, electrical drawings (contract drawings) are diagrammatic in nature and may not show locations accurately for various components of electrical systems. Submittals prepared by Contractor show certain portions of work more accurately to scale and location, and in greater detail. It is recognized that actual layout of installed work may vary from both contract drawings and submittals.
- B. Maintain white-print set (blue-line or black-line) of electrical contract drawings and shop drawings in clean, undamaged condition for mark-up of actual installations which vary substantially from work as shown. Mark-up whatever drawings are most capable of showing installed conditions accurately; however, where shop drawings are marked, record reference note on appropriate contract drawing. Mark with erasable pencil, and use multiple colors to aid in distinguishing between separate electrical systems. In general, record every substantive installation of electrical work which previously is either not shown or shown inaccurately, but in any case record the following:
 - 1. Work concealed behind or within other work, in a non-accessible arrangement.
 - 2. Mains and branches of wiring systems, with switchboards, panelboards, and control equipment and devices located and numbered.
 - 3. Scope of each change order, denoting C.O. number.
 - 4. Grounding systems.
 - 5. Sensor and signal locations of control systems.
 - 6. Updated panelboard schedules in Excel format.
- C. Transmit mark-up drawings as submittal to Architect for Owner's use and record.

1.13 WARRANTY/GUARANTEE:

- A. Guarantee all labor and materials for a period of twelve (12) months from the date of final notice of final acceptance of the work or as required by Division 1, whichever is longer. Repair all defective materials and work; replace with new materials and/or equipment, any material and/or equipment failing to give satisfactory service.
- B. During the period of guarantee, promptly correct any defects in equipment, materials or workmanship without cost to the Owner.

1.14 TESTS AND BALANCING:

- A. Conduct operating tests to demonstrate that electrical systems are installed and will operate properly and in accordance with the requirements of this Specification. Tests shall be performed in the presence of the Architect's representative. Furnish instruments and personnel required for such tests.
- B. Replace any work or materials tested and found varying from the requirements of the Drawings and Specifications without additional cost to the Owner.

1.15 ALTERNATES

- A. There may be certain alternates involved in the construction. Be aware of and provide appropriate adjustments for all alternates described in the specifications or on the drawings. See architectural drawings for detail.

1.16 DRAWINGS AND SPECIFICATIONS:

- A. Conform to arrangement indicated by contract documents, recognizing that portions of work are shown only in diagrammatic form.
- B. Materials, work, or equipment not mentioned, but normally necessary for the proper execution of this work, shall be provided as if specifically called for.
- C. The drawings show approximate locations of feeders, branch circuits, outlets, etc., except where specific routing or dimensions are shown. The Architect reserves the right to make reasonable changes in locations, before roughing-in, without additional cost to the Owner.
- D. Because of the small scale of the drawings, it is not possible to show all of the offsets, fittings, and accessories required. Investigate structural and finish conditions and arrange work accordingly, furnishing fittings, bends, junction boxes, pull boxes, access panels, and accessories required to meet such conditions.
- E. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of conflict.

1.17 REGULATORY COMPLIANCE

- A. Applicable sections of National Fire Protection Association (NFPA) standards (latest edition) including the National Electrical Code and applicable codes or ordinances shall apply as minimum standards.

1.18 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall conform to the requirements set forth in these specifications and the accompanying drawings. See Division 1 sections for provisions regarding substitutions.
- B. Except as otherwise specified, materials and equipment shall be new and bear the approval label of the Underwriters' Laboratories, Incorporated.

- C. All prior approvals shall be submitted to the architect a minimum of ten business days prior to the advertised bid date. All lighting prior approval requests shall be provided with point by point footcandle calculations for **all areas** within project scope and installation details showing that fixtures can be installed per architectural ceiling details, contact architect for floorplans required for calculations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. All materials, equipment and devices shall be installed in accordance with the recommendations of their manufacturer.
- B. Comply with NECA 1 - Standard Practices for Good Workmanship in Electrical Construction, as published by the National Electrical Contractors Association.
- C. Use licensed technicians skilled in their respective trades for installation of the Work.
- D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise indicated.
- E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- G. Right of Way: Give to piping systems installed at a required slope.
- H. Access Panels: Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or nonremovable suspended ceilings. Access Panel materials and installation requirements are specified in Division 08 Section "Access Doors and Frames."
- I. Installation Inspections and Certifications
 - 1. Obtain timely inspections of the installation by Authorities Having Jurisdiction. Remedy any deficiencies to the satisfaction of the inspecting official.
 - 2. Upon final completion of the Work, obtain certificates of acceptance from the Authorities Having Jurisdiction. Deliver the certificates to the Owner.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of slabs and walls.
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Exception: Slab-on-grade construction shall not require sleeves or curbed formed openings when conduits or pipes that penetrate the slab-on-grade are installed and properly supported prior to the pouring of the slab.
- C. Masonry Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of walls.
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping." At minimum, utilize STI EZ Path Series pathways for low voltage cabling. Provide n+1 redundancy at fire-rated wall penetrations.
- F. Non Fire-Rated Assemblies: Install sleeves where cable penetrations occur. Install sleeves during erection of walls.
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- G. Cut sleeves to length for mounting flush with both surfaces of walls.
- H. Extend sleeves installed in floors a minimum of 2 inches (50 mm) above finished floor level.
- I. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless otherwise indicated.
- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 - 2. Apply approved joint compound for gypsum board assemblies where masonry or concrete wall is faced on interior side with gypsum board.
- K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

- L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Roof-Penetration Sleeves: Seal penetration of individual conduits and cables with flashing units applied in coordination with roofing work. Provide flashing unit as specified in Division 07 Section "Sheet Metal Flashing and Trim".
- N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- O. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.4 OPTION TO RELOCATE DEVICES

- A. The location of receptacles, wall switches, data outlets, and other similar devices along with their associated connections and cabling may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to rough-in or installation.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 CONNECTIONS

- A. Phase Rotation: Prior to installing any connections or energizing any equipment, perform Phase Rotation verification test at the following:
 - 1. Utility Transformers
 - 2. Engine Generators
 - 3. Motors
- B. Mechanical Controls: Provide 120VAC power connections as required to components of Mechanical Control system. Coordinated quantity of circuits, connection requirements and locations between trades and with provisions of Divisions 21, 22, and 23 sections.
- C. HVAC Terminal Boxes: Where the Drawings indicate a 120VAC circuit in a general area and labeled for terminal boxes (VAV, etc.), the intent is for this circuit to be

extended and connected to the terminal box in that general area. Coordinate connection requirements and locations between trades and with provisions of Division 23 Sections and Drawings.

- D. Smoke Dampers: Where the Drawings indicate a 120VAC circuit in a general area and labeled for dampers, the intent is for this circuit to be extended and connected to the Smoke and Fire/Smoke dampers in that general area in coordination with the smoke control sequence. Coordinated connection requirements and locations between trades and with provisions of Division 23 Sections and Drawings.
- E. Security and Access Control: Where the Drawings indicate a 120VAC circuit in a general area labeled for security or access control use, the intent is for this circuit to be extended and connected to the security or access control device in that general area in coordination with other trades. Coordinated connection requirements and locations between trades and with Owner's Security vendor prior to installation.
- F. Motors and Motor Connections: Motors for driven equipment are specified in Divisions 21, 22, and 23. Provide connections as follows, unless otherwise indicated:
 - 1. Equipment provided with factory installed disconnecting means: Upon installation of motor and associated equipment, Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
 - 2. Equipment furnished with factory disconnecting means: Upon installation of motor and associated equipment, Install factory furnished disconnecting means and provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
 - 3. Equipment not furnished with factory installed disconnecting means: Provide disconnect switch required in accordance with NFPA 70 or as indicated on the Drawings. Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
- G. Owner Furnished Equipment: Power Connections and Control wiring required for Owner Furnished Equipment may not be shown on the Drawings. This wiring and connections shall be provided. Coordinated connection requirements and locations with Owner. Provide breakers, disconnects, conduits, wiring, etc. as required for complete installations.
 - 1. Request all rough-in documentation required for proper installation of the electrical work in ample time to permit preparation of the installation drawings.

3.8 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."
- B. Apply putty pads to boxes located in fire-rated wall assemblies in which a horizontal distance of greater than 24" between boxes is not maintained. Putty pad materials

and installation requirements are specified in Division 09 Section "Gypsum Board Assemblies."

- C. Provide STI EZ-Path fire rated sleeves for all low voltage cable required to pass through rated walls. See architectural drawings for rated wall locations. See drawings for more information.

3.9 SEALANT

- A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA for all pressure sensitive rooms including: Isolation rooms, Protective Environment rooms, Operating rooms, and Pharmacy including Chemo Prep, Sterile Prep and Ante rooms. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies."

3.10 FIELD QUALITY CONTROL

- A. Conduct tests as part of the Work of this Division. Include the services of qualified personnel as well as all equipment, apparatus, and services required.
- B. Conduct tests under conditions free from short circuits and from grounds.
- C. Insure insulation resistance prior to test is within the requirements of the latest edition of the NFPA 70.
- D. Prior to execution of testing, notify Architect of proposed test procedures and forms.
- E. Testing requirements are listed under individual sections of this Division. Sections requiring testing include, but are not limited to the following:
 - 1. Wire and cable insulation, in accordance with Division 26 Section "Low-Voltage Electrical Power Conductions and Cables."
 - 2. Grounding system continuity, in accordance with Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 3. Lighting control devices, in accordance with Division 26 Section "Lighting Control Devices."
 - 4. NETA tests for transformers, in accordance with Division 26 Section "Low-Voltage Transformers."
 - 5. NETA tests and startup for panelboards, in accordance with Division 26 Section "Panelboards."
 - 6. Receptacle polarity, and ground resistance testing in accordance with Division 26 Section "Wiring Devices."
 - 7. NETA tests and startup for enclosed switches and circuit breakers, in accordance with Division 26 Section "Enclosed Switches and Circuit Breakers."
 - 8. Emergency lighting tests, in accordance with Division 26 Section "Interior Lighting."
 - 9. NETA thermographic survey on all electrical system equipment.

3.11 COORDINATION OF ELECTRICAL INSTALLATION

- A. Sequence, coordinate, and integrate various elements of electrical work so that electrical system will perform as indicated. Architect/Engineer will not supervise coordination, which is exclusive responsibility of Contractor. Where drawings call for the contractor to facilitate meetings on site, coordinate dates/times with architect and engineer. Provide a minimum of 2 week notice.
- B. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on wiring devices and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work. Locate operating and control equipment and devices for easy access.
- C. Install access panels where electrical work requiring access is concealed by finishes and similar work.
- D. Integrate electrical work in ceiling plenums, including lighting fixtures, with ceiling finish, suspension, ductwork, air diffusers and other work, so that required performances of each will be achieved.
- E. Give right-of-way in confined-service spaces to piping which must slope for drainage and to larger HVAC ductwork and similar services which are less conformable than electrical services.
- F. **All wiring installed in air plenums shall be plenum rated.**
- G. Prior to start of demolition, contractor shall fill out owner's document titled "Maintaining Accurate Inventories and Locations during the Commissioning and Decommissioning of Life Safety Items During Construction/Renovation." Coordinate with general contractor and fill out applicable electrical portions of document.

3.12 WIRING METHODS - GENERAL

- A. All wiring shall be run in conduit or other type raceways unless specifically noted or allowed otherwise by the Owner.
- B. Wiring run without raceways or not in cable tray shall be bundled together with reusable Velcro wraps (not nylon tie wraps) at least once between each 4'-0" support. Wiring shall be routed on the supports as high as possible, free and clear of mechanical equipment, lighting fixtures, piping, conduits, ductwork, building structural members and any other building equipment or items.
- C. Cables shall not rest on the ceiling support grid system or other building items. Do not support from ceiling system supports, HVAC ductwork, conduit, piping, etc. Any cables found to be installed improperly will be noted and the contractor will be required to properly support the cables at no cost to the owner. Prior to the start of construction, the contractor shall make note of existing cables to remain that are improperly installed and inform the owner of such conditions. Coordinate correctional work with owner.
- D. Where wiring run without raceways penetrates walls or ceilings, a metal conduit sleeve with bushings at each end shall be provided for the penetration. Cables shall not be run through holes in walls or ceilings. See above Section 3.8 for more information.

- E. Each cable shall be continuous, without splices or connections from the source to the connected device. Routing shall be parallel or perpendicular to building walls. Support arrangement and tension on cables shall be minimized to prevent exceeding the maximum cable bending radius. Where cables transition from sections run without a raceway into sections run with a raceway, a bushing shall be installed on the entrance to the raceway (conduit, Wiremold, etc.).

3.13 CLOSEOUT PROCEDURES

- A. General: Refer to Division 1 sections for coordination of closeout work for electrical systems. Sequence closeout procedures properly, so that work will not be endangered or damaged, and so that required performance will be fully tested and demonstrated.
- B. Cleaning: After final performance test run of each electrical system, clean system both externally and internally. Touch-up minor damage to factory-painted finishes; refinish work where damage is extensive.
- C. General Operating Instructions: Provide general operating instructions for each operational system and equipment item of electrical work.
- D. Provide receptacle testing as outlined in NFPA 99. Provide the following testing for receptacles installed in patient care areas. Provide written documentation for all testing in closeout documents.
 - 1. The physical integrity of each receptacle shall be confirmed by visual inspection.
 - 2. The continuity of the grounding circuit in each electrical receptacle shall be verified.
 - 3. The correct polarity of the hot and neutral connections in each electrical receptacle shall be confirmed.
 - 4. The retention force of the grounding blade of each electrical receptacle (except locking-type receptacles) shall be not less than 115 grams (4 ounces).

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Provide break out pricing for deductive alternate to use aluminum conductors, on feeders only sized 150A and greater.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.
- C. VFC: Variable frequency controller.

1.3 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 – PRODUCTS.
- B. Product Data: For each type of product indicated. Provide data for conductors and cables including, but not be limited to, the following:
 - 1. Complete physical properties of the conductors and cables.
 - 2. Ampacity for use intended.
 - 3. Allowable stresses and requirements for installations, including bend radii, linear stress, and other pertinent data.
 - 4. Types of connectors for terminations.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical". Include the following:

1. Feeder cable routing plans, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Structural members in the paths of conduit groups with common supports.
 - b. HVAC, plumbing items, and architectural features in the paths of conduit groups. Denote where systems share common supports.
 - c. New routes for review if required.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For conductors and cables, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 1. Manufacturer's routine maintenance requirements for cables, terminations and all installed components.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 26 Section "Common Work Results for Electrical".

1.7 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Alcan Products Corporation; Alcan Cable Division.
 2. Alpha Wire.
 3. Belden Inc.
 4. Encore Wire Corporation.
 5. General Cable Technologies Corporation.
 6. Southwire Incorporated.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

- C. XHHW Conductors: Comply with NEMA WC 70.
- D. Aluminum Conductors: XHHW-2
 - 1. Comply with NEMA WC 70.
 - 2. AA-8000 series electrical grade aluminum alloy conductor material in compliance with NFPA 70, Chapter 3.
 - 3. Compact stranded conductors.
- E. Shielded Variable Frequency Drive Cable: Shielded Conductor and signal cable with symmetric bare grounds and overall shield to block EMI and RFI interference.
 - 1. Conductor Material: stranded tinned copper
 - 2. Shield: Foil tape and tinned copper braid shield
 - 3. Comply with 2000V UL 1277 Type TC-ER per 2005 NEC Article 336
 - 4. Rated for 90°C wet/dry
 - 5. Suitable for Class I & II; Division 2 hazardous locations
 - 6. Comply with UL 1685 vertical tray flame test
 - 7. Comply with IEEE 1202 vertical tray flame test at 70,000 BTU/hour
 - 8. Comply with CSA FT4
 - 9. Comply with Oil & Sunlight resistant
 - 10. RoHS compliant and CE approved.
- F. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Types THHN-THWN, XHHW, XHHW-2 and SO, as indicated.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Gardner Bender.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. IlSCO; a branch of Barden Corporation.
 - 6. NSI Industries LLC.
 - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 8. 3M; Electrical Markets Division.
 - 9. Tyco Electronics.
 - 10. WAGO Corporation.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 MISCELLANEOUS PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength: 50 lb (22.6 kg), minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding. Refer to Division 26 Section "Identification for Electrical Systems" for color-coding requirements.

2.4 SYSTEM DESCRIPTION

- 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 NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for all feeders, aluminum for feeders where indicated on Drawings. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Provide conductors with minimum temperature ratings of 75 degrees C. For high temperature applications, provide conductors with temperature ratings in accordance with the NFPA 70 for the ambient condition.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Underfloor and Underground:
 - 1. All cables run under the floor level (or underground) shall comply with the FM Global Property loss prevention data sheets for flooding. Provide protected metallic armoring or shields that are designed for use in a wet environment on all feeders and branch circuits installed in these areas.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits below Slabs-on-Grade, and Underground in limited locations where indicated: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

- E. Branch Circuits served from Isolation Panelboards: Copper stranded Low leakage Type XHHW conductor with a dielectric constant of 3.5 or less in raceway.
- F. Connections to Luminaires on Normal System: Armored Cable, Type AC-HCF, maximum of 144 inches (3660 mm).
- G. Connections to Luminaires on Essential/Emergency System: Armored Cable, Type ACHCF, maximum of 144 inches (3660 mm).
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application. N. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- O. Class 2 and 3 Control Circuits; Concealed in Ceilings, Walls or Partitions: Power-limited cable or Type THHN-THWN, in raceway.
- P. Class 2 and 3 Control Circuits; Exposed: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Run feeders in continuous lengths, without joints or splices. Where continuous runs are impractical; obtain Engineer's approval for splice locations and application.
- B. Make joints in branch circuits only where circuits divide.
- C. Do not use gutters of panelboards as raceways, junction boxes, or pull boxes for conductors not terminating in said panelboards.
- D. Run conduits for emergency power conductors separate from all other wiring.
 - E. Make splices and terminations in cables with kits and instructions provided by the kit manufacturer. Each splice shall equal the integrity of the cable electrically and environmentally.
- F. Bundling Conductors: Bundle conductors in switchboards, panelboards, cabinets, and the like, using nylon ties made for the purpose. Bundle conductors larger than No. 10 in individual circuits. Smaller conductors may be bundled in larger groups.
- G. Install all conductors in raceways, unless otherwise indicated.
- H. Sizes
 - 1. Provide conductors no smaller than No. 12 AWG, except for signal or control circuits.

2. Provide No. 10 AWG conductors for home runs on 120-volt, 20-ampere branch circuits, where the conductor length exceeds 100 linear feet from panelboard to the first device.
3. Provide No. 10 AWG conductors for home runs on 277-volt, 20-ampere branch circuits, where the conductor length exceeds 200 lineal feet from panelboard to the first device.
4. Provide neutral conductors of the same size as the phase conductor(s) for individual branch circuit homeruns.
5. Run dedicated neutral conductor with each branch circuit. Sharing of neutral conductors in multi-circuit homeruns is not acceptable.
 - a. Sharing of neutrals would necessitate the use of multiple-pole or tied branch circuit breakers to allow simultaneous disconnecting of current carrying conductors in order to comply with NFPA 70 requirements and therefore is unacceptable.
6. Grouping of Multi-Circuit homeruns: grouping of multiple circuits into shared conduit homeruns is acceptable where they comply with the quantities and sizes listed in Table "A" below and where homeruns meet the following conditions:
 - a. Where conductors are THWN/THHN installed in dry location.
 - b. Where raceways are installed in ambient conditions less than 30-Deg C (86Deg F).
 - c. Consider neutral conductors as a current carrying conductor in branch circuits which serve receptacles or electronic ballasted luminaries.

TABLE A

Number of Current Carrying Conductors in single raceway	Conductor Size for 20Ampere Single Pole Circuit	Conduit Size based on EMT
2 to 3	#12 AWG (THHN 75-Deg) or #12 AWG (THHN 90-Deg)	3/4" EMT
4 to 6	#12 AWG (THHN 75-Deg) or #12 AWG (THHN 90-Deg)	3/4" EMT
7 to 9	#10 AWG (THHN 75-Deg) or #12 AWG (THHN 90-Deg)	1" EMT 3/4" EMT
10 to 20	#10 AWG (THHN 90-Deg)	1.25" EMT

H. Notes:

1. Conductor and conduit sizes in table above are based on total conductor lengths under 100 linear feet for 120-volt (200 linear feet for 277-volt) from panelboard to the first device, 20-ampere branch circuits. Increase conductor and conduit size in accordance with NFPA 70 for longer lengths.
- I. Terminations of multiple branch circuit conductors on a single circuit breaker is not acceptable.

- J. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- K. Complete raceway installation between conductor and cable termination points according to Division 16 26 Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- L. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours.
- M. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- N. Feeders and Branch circuits concealed in concrete are prohibited.

3.4 WIRE PULLING

- A. Pull no conductors into conduits until all Work of a nature which may cause injury to conductors is completed.
- B. Follow manufacturers' recommendations for regulating temperature conditions of conductors prior to installation.
- C. Exercise care in handling and installing cables to avoid damage. Carefully form cables in equipment pull boxes. Form bends in cables larger than the minimum radii shown in the cable manufacturer's published data for minimum bends such that bends will not reduce the cable life.
- D. Provide suitable installation equipment to prevent abrasion and cutting of conductors by raceways during the pulling of conductors. Use ropes of polyethylene, nylon or other suitable non-metallic material to pull in feeders. Metallic ropes are prohibited.
- E. Attach pulling lines to conductors by means of insulated woven basket grips or by pulling eyes attached directly to conductors. Do not use rope hitches, or bare steel basket grips. All conductors to be installed in a single conduit shall be pulled in simultaneously.
- F. Before any wire is pulled into any conduit, thoroughly swab the conduit to remove all foreign material and to permit the wire itself to be pulled into a clean, dry conduit.
- G. Use manufacturer-approved pulling compound or lubricant where necessary, of nonconducting type. Compounds used must not deteriorate the conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. Do not use cable pulling lubricants on conductors of ungrounded circuits which are electrically monitored by ground detector system, since such lubricant may increase the capacities to ground of these conductors. Including, but not limited to, conductors on the secondary side of Isolation Panels.

3.5 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor.
- C. Wiring at Outlets: Install conductor at each device, with at least 6 inches (150 mm) of slack.
- D. Wiring at lighting control locations: Install a neutral conductor at each switch location controlling line-to-neutral lighting loads.
- E. Connectors: Make splices and connections in conductors using approved connectors.
 - 1. Provide lugs and connectors of proper size to match conductor size.
 - 2. Stranded Conductors: Solder-less, bolted pressure or compression connectors.
 - 3. Solid Conductors: Bolted pressure or spring connectors.
 - 4. Motor Lead Pigtails: Crimp lugs with through-bolt fasteners between lugs. Furnish proper sized dies and tools to apply connectors.
 - 5. Lighting Fixture Taps: Electrical spring connectors as specified for solid conductors.
 - 6. Ground Connections: Ground connection materials and installation requirements are specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Provide temperature ratings of connectors and splices to match wire rating.
- G. Connections for Aluminum Conductors using Mechanical Screw Type Connectors:
 - 1. Connectors shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
 - 2. Using a suitable stripping tool, to avoid damage to the conductor, remove insulation from the required length of the conductor.
 - 3. Clean the conductor surface using a wire brush and apply a Listed joint compound.
 - 4. Tighten the connection per the connector manufacturer's recommendation.
 - 5. Wipe off any excess joint compound.
- H. Connections for Aluminum Conductors using Mechanical Compression Type Connectors:
 - 1. Connectors shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.

2. The lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color coded. Lug barrel shall be factory prefilled with a joint compound Listed by UL.
 3. Using a suitable stripping tool, to avoid damage to the conductor, remove insulation from the required length of the conductor.
 4. Clean the conductor surface using a wire brush.
 5. Crimp the connection per the connector manufacturer's recommendation.
 6. Wipe off any excess joint compound.
- I. Termination of Aluminum Conductor to Aluminum Bus:
1. Prepare a mechanical connection conforming to F or G above.
 2. Hardware:
 - a. Bolts: Anodized aluminum alloy 2024-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
 - b. Nuts: Aluminum alloys 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
 - c. Washers: Flat aluminum alloy 2024-T4, Type "A" plain, standard wide series conforming to ANSI B27.2.
 - d. Lubricate and tighten the hardware as per the manufacturer's recommendations.
- J. Termination of Aluminum Conductor to Copper Bus:
1. Prepare a mechanical connection conforming to F or G above.
 2. Hardware:
 - a. Bolts: Plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to ASTM A-325 or SAE grade 5.
 - b. Nuts: Heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B.
 - c. Washers: Steel; Type A plain standard wide series conforming to ANSI B27.2.
 - d. Belleville conical spring washers: hardened steel, cadmium plated or silicone bronze.
 - e. Lubricate and tighten the hardware as per the manufacturer's recommendations.
- K. Termination of Aluminum Conductor to Equipment Not Equipped for Termination of Aluminum Conductor:
1. Prepare compression connection using an adapter Listed by UL for the purpose or by pigtailling a short length of suitable size of copper conductor to the aluminum conductor with a compression connector Listed by UL.
 2. Provide an insulating cover over adapter body or the compression connector.
 3. Terminate the adapter or the pigtail on to the equipment per manufacturer's recommendation.

3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 26 Section "Common Work Results for Electrical."

3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each feeder, and branch circuit.
 - 2. Test continuity of each circuit.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 26 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors, and conductors of No. 2 AWG and larger for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for one minute.
- E. Perform continuity test to insure correct cable connection.
- F. Test Values

a. Bolt-torque levels shall be in accordance with Table 1.1 thru Table 1.4, unless otherwise specified by the manufacturer.

Table 1.1 - Bolt Torque for Bus Connection using Cadmium or Zinc Plated Heat-Treated Steel

Grade	SAE 1 & 2	SAE 5	SAE 7	SAE 8
Minimum Tensile (P.S.I.)	64K	105K	133K	150K
Bolt Diameter (Inches)	Torque (Foot Pounds)			
1/4	4.0	5.6	8.0	8.4
5/16	7.2	11.2	15.2	17.6
3/8	12.0	20.0	27.2	29.6
7/16	19.2	32.0	44.0	48.0
1/2	29.6	48.0	68.0	73.6
9/16	42.4	70.4	96.0	105.6
5/8	59.2	96.0	133.6	144.0
3/4	96.0	160.0	224.0	236.8
7/8	152.0	241.6	352.0	378.4
1	225.6	372.8	528.0	571.2

Table 1.2 - Bolt Torque for Bus Connection using Silicon Bronze Fasteners ¹

	Non-Lubricated	Lubricated
Bolt Diameter (Inches)	Torque (Foot Pounds)	
5/16	15.0	10.0
3/8	20.0	14.0
1/2	40.0	25.0
5/8	55.0	40.0
3/4	70.0	60.0

¹ Aluminum alloy bolts with minimum tensile strength of 55,000 pounds per square inch.

Table 1.3 - Bolt Torque for Bus Connection using Aluminum Alloy Fasteners ²

	Lubricated
Bolt Diameter (Inches)	Torque (Foot Pounds)
5/16	8.0
3/8	11.2
1/2	20.0
5/8	32.0
3/4	48.0

² Aluminum alloy bolts with minimum tensile strength of 55,000 pounds per square inch.

Table 1.4 - Bolt Torque for Bus Connection using Stainless Steel Fasteners ³

	Uncoated
Bolt Diameter (Inches)	Torque (Foot Pounds)
5/16	14.0

3/8	25.0
1/2	45.0
5/8	60.0
3/4	90.0

³ Bolts, cap screws, nuts, flat washers, locknuts: 18-8 alloy. Belleville washers: 302 alloy.

- b. Minimum insulation-resistance values shall be not less than 50 megohms.
- c. Investigate deviations between adjacent phases.

2. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.

- a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each termination of or splice in cables and conductors No. 3 AWG and larger. Open or remove doors and covers so connections are accessible to portable scanner.
- b. Instruments, Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. G. Cables will be considered defective if they do not pass tests and inspections.

H. Correct Deficiencies, Retest and Report:

- a. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
- b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- c. Prepare a written report to record the following:
 - i. Procedures used.
 - ii. Results that comply with requirements, identifying conductor, units, and devices checked.
 - iii. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 - iv. Observations and test results after remedial action.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. NFPA 70 and IEEE C2 include basic grounding requirements for electrical safety. This Section supplements the minimum safety requirements of the Code with requirements for additional grounding and with optional grounding methods and materials for both power and electronic systems.
- B. This Section includes methods and materials for grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Common ground bonding with lightning protection system.
- C.

Related Sections include the following:

- 1. Division 26 Section "Lightning Protection for Structures" for common ground bonding with lightning protection system.
- 2. Division 27 Section "Grounding and Bonding for Communications Systems" for common ground bonding of Communications Systems including grounding bus.

1.2 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS
- B. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
 - 5. Grounding for sensitive electronic equipment.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - 1. Manufacturer's routine maintenance requirements for cables, terminations and all installed components.
 - 2. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems, test wells and ground rings based on NETA MTS.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 26 Section "Common Work Results for Electrical".
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.
- D. Comply with NFPA 70.
- E. Comply with NFPA 99.
- F. Comply with IEEE C2.
- G. Comply with ANSI-J-STD-607-A.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. Dossert; AFL Telecommunications LLC.
 - 3. ERICO International Corporation.

4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction. B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
6. Main Bonding Jumper: stranded copper conductors sized as indicated on Drawings.
7. Grounding Electrode Conductor: stranded copper conductors sized as indicated on Drawings.
8. Common Grounding Electrode Conductor: stranded copper conductors sized as indicated on Drawings.

2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure type, long barrel with at least two bolts.
1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING BUSBARS

- A. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, 20 inches (500 mm) in length, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V, unless otherwise indicated.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 inch (16 mm) diameter by 120 inches (3000 mm) long, unless otherwise indicated.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Insulated solid or stranded for No. 10 AWG and smaller, insulated stranded for No. 8 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG minimum.
 - 1. Bury at least 30 inches (762 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inch (50 mm) minimum, from wall 12 inches (300 mm) above finished floor or 6 feet above transformer, unless otherwise indicated.
 - 2. Clean and apply anti-oxidant to the contact area prior to conductor connection.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Dry-Type Transformers: Install an insulated grounding conductor from the common point of connection of the transformer secondary neutral point and the transformer enclosure to the following:
 - 1. The nearest grounding electrode per NFPA 70, including but not limited to building steel where available.
 - 2. The grounding bus of the common electrode grounding system, located in the electrical equipment room.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
 - 1. Bond to each device, box, and luminaire, unless otherwise indicated.
 - 2. Conduction insulation of the same rating as the phase conductors, for all feeders and branch circuits. Install the grounding conductors in the raceway with related phase and neutral conductors.
 - 3. Where parallel conductors in separate raceways occur, provide a grounding conductor in each raceway that meets requirements of NFPA 70.
- B. Enclosures: Install an insulated grounding conductor from grounding bushings to the frame of the enclosure, ground bus, and equipment grounding strap where each occurs. Install grounding bushings on all raceways connecting electrical enclosures constructed of separate enclosure panels, which are not integrally welded together.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to ductmounted electrical devices operating at 120 V and more, including but not limited to air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from

raceway. Terminate at grounding conductor terminal on isolated ground bus of equipment of the applicable derived system or service, unless otherwise indicated.

- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway. Terminate at grounding conductor terminal on isolated ground bus of equipment of the applicable derived system or service, unless otherwise indicated.

3.5 INSTALLATION

- A. Provide permanent service neutral and equipment grounding in accordance with NFPA 70 and subject to the following additional requirements.
- B. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Connect the service neutral and equipment ground to a common point within the metallic enclosure containing the main service disconnecting means. Equipment grounds and the identified neutral of the wiring system shall not be interconnected beyond this point in the interior wiring system. From the common point of connection of the service neutral and the equipment ground, run in non-magnetic conduit a grounding electrode conductor without joint or splice to the grounding electrode system and connect it with an approved bolted pressure clamp.
- D. Ground Rods: Drive rods until tops are 12 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor a minimum of 30 inches below grade unless otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- E. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- F. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
4. Where expansion joints or telescoping joints occur, provide bonding jumpers.

H. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- I. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components as specified in Division 26 Section "Identification for Electrical Systems."

3.7 CONNECTIONS

- A. Ground Connections: Provide ground clamps or connectors of a suitable type for ground applications.
- B. Ground Bars: Irreversible exothermic welded connector.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 26 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
- B. Perform the following field tests and inspections and prepare test reports:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without 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.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Tests for patient-care areas: In addition to the test listed above, perform additional field tests and inspections for patient care areas. Patient care areas are defined by the LAHJ.
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements. Perform the following tests:
 - a. Impedance: Measurement shall be made between the reference point and the grounding contact of all receptacles in the patient care room. The maximum limit allowed is 0.1 ohms.
 - b. Voltage: Measurement shall be made under no-fault conditions between a reference point and all exposed fixed electrical equipment with conductive surfaces in the patient care vicinity, including but not limited to: overbed wallmounted fixtures, ceiling mounted exam lights, sensor faucets, etc. The maximum limit allowed is 20mV.
 2. Prepare certified test reports in compliance with NFPA 99 and submit reports in conjunction with field quality control reports required in Division 26 Section

"Wiring Devices". Utilize the Patient Care Area Electrical Testing Form in the Appendix of this section for each patient care area.

- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
 - 1. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - d. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 - e. Substations and Pad-Mounted Equipment: 5 ohms.
 - f. Manhole Grounds: 10 ohms.
 - g. Correct Deficiencies, Retest and Report:
 - 2. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and rods as required to bring system into compliance.
 - 3. Prepare a written report, certified by testing agency, to record the following:
 - a. Procedures used.
 - b. Results that comply with requirements, identifying components checked.
 - c. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 - d. Observations and test results after remedial action.

END OF SECTION

APPENDIX

PATIENT CARE AREA ELECTRICAL SYSTEM INSPECTION / TESTING FORM

DATE: _____

ROOM NO: _____

LOCATION: _____

INSTRUMENTATION: _____

INSPECTED BY: _____

Room Rcpt. No.	Mechanical Condition	Wiring / Polarity	Contact Tension			Voltage		GFCI Trip	Ground Potentials (millivolts)	Ground Resistance (Ohms)
			H	N	O	H-N	N-O			

REMARKS: _____

REFERENCE POINTS: _____ (mark on sketch)

ROOM LAYOUT SKETCH

END OF APPENDIX

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. RAC: Rigid aluminum conduit.
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. RSC: Rigid Steel conduit.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of **<five>** times the applied force.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Atkore International.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.
 - 4. Rated Strength: Selected to suit applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Device Box Mounting Brackets and Stabilizer: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Cooper B-Line, Inc.
 - b. ERICO International Corporation.
- F. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.
 - b. ERICO International Corporation.
- G. Roof-mounted Raceway Support Blocking: Factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UVresistant Rubber with integral galvanized steel strut to accept raceway support clips.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cooper B-Line C-Port series components or a comparable product by one of the following:
 - a. Cooper B-Line, Inc.
 - b. ERICO International Corporation.
- H. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.
 - b. ERICO International Corporation.
- I. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- J. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Cooper B-Line, Inc.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 5. Toggle Bolts: All-steel springhead type.
 6. Hanger Rods: Solid, threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NFPA 70, NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.
- B. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for EMT, IMC, and RMC as required by NFPA 70.
- C. Minimum Hanger Rod Size for Raceway Supports: Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Single Raceways or Cables:
 1. For Raceways 1-1/4-inch (32mm) and smaller: Install adjustable steel band hanger suspended on threaded rod.
 2. For Raceways larger than 1-1/4-inch (30mm): Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods. Size trapeze members, including the suspension rods, based on the support required for the size, and loaded weight of the conduits.
 - a. Secure raceway or cable to support with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods, where multiple raceways are run vertically or horizontally at the same elevations. Size trapeze members, including the suspension rods, based on the support required for the number, size, and loaded weight of the conduits. Space them as required for the smallest conduit to be supported. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- G. Corrosive Areas: Provide coated steel slotted support systems for supports installed in corrosive areas. Corrosive areas include, but are not limited to the following:
 1. Pools and Pool Equipment Areas.
 2. Within 25-feet (7.62-m) of Cooling Towers and Air Cooled Chillers.
 3. Dishwashing Machine Areas.

3.2 SUPPORT INSTALLATION

- A. Comply with NFPA 70, NECA 1 and NECA 101 for installation requirements except where requirements of this Article are more stringent.
- B. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.
- C. Install Device Box Mounting Brackets supported between two studs where boxes are not located adjacent to stud or where multiple boxes are located between studs.
- D. Device Box shall not be supported by a single stud, but shall be positively attached to a support device between studs.
- E. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.
- F. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings.
 1. Install at least one independent support rod from box hanger to structure.
- G. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.
 1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work.
- H. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.
- I. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.

- J. Locate raceways so as not to hinder access to mechanical equipment.
- K. Do not secure conductors, raceways, or supports to suspended ceiling hanger rods or wires.
- L. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- M. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured, if possible. Fit each hanger rod with a nut at its upper end, and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP69 or Spring-tension clamps.
 - 6. To Light Steel: Sheet metal screws.
 - 7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
 - 8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to . Attachment to gypsum wall board is not acceptable as sole support means.
- N. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.
- O. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars. Verify reinforcing locations with Structural Engineer. X-Ray existing concrete structures as required.

3.3 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 3 inches (100 mm) larger in all directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-inPlace Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- D. All floor mounted equipment shall be provided with concrete base, unless otherwise indicated.

3.4 PAINTING

- A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Metal wireways and auxiliary gutters.
 - 3. Surface raceways.
 - 4. Boxes, enclosures, and cabinets.
- B. Provide raceways and boxes for all the other systems, as specified in other Sections of Divisions 26, 27 and 28.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical non-metallic tubing.
- C. EPC: Electrical Plastic Conduit
- D. EPDM: Ethylene-propylene-diene terpolymer rubber.
- E. FMC: Flexible metal conduit.
- F. IMC: Intermediate metal conduit.
- G. LFMC: Liquidtight flexible metal conduit.
- H. LFNC: Liquidtight flexible nonmetallic conduit.
- I. NBR: Acrylonitrile-butadiene rubber.
- J. RAC: Rigid aluminum conduit.
- K. RMC: Rigid metal conduit.
- L. RSC: Rigid Steel conduit.

1.3 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

- C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical". Include the following:
 - 1. Raceway routing plans, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Proposed cable pull points.
 - a. Structural members in the paths of conduit groups with common supports.
 - b. HVAC, plumbing items, and architectural features in the paths of conduit groups. Denote where systems share common supports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store raceway components indoors to prevent water or other foreign materials from staining or adhering to components. Unpack and dry wet materials before storage.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. FSR Inc.
 - 6. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
 - 7. Patriot Aluminum Products, LLC.
 - 8. Picoma Industries.
 - 9. Republic Conduit.
 - 10. Robroy Industries.
 - 11. Southwire Company.
 - 12. Thomas & Betts Corporation.
 - 13. Western Tube and Conduit Corporation.
 - 14. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RSC: Comply with ANSI C80.1, UL 6, and NEMA FB 2.10; Galvanized rigid steel, each length with a coupling on one end and thread protector on opposite end.

- D. RAC: Comply with ANSI C80.5, UL 6A, and NEMA FB 2.10; Rigid aluminum, each length with a coupling on one end and thread protector on opposite end. E. IMC: Comply with ANSI C80.6, UL 1242, and NEMA FB 2.10.
- F. Fittings for RSC, RAC and IMC: Provide factory made threaded couplings of same material as the conduit.
 - 1. Molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside and outside box or cabinet. In wet locations, provide watertight hubs for conduit entry into enclosures.
 - 2. Thermoplastic insulated grounding bushing on all conduits where grounding bushings are required, with locknuts inside and outside the enclosure. In wet locations provide watertight hubs for conduit entry into enclosures.
 - 3. Expansion joints: O-Z/Gedney or acceptable submission, with internal ground and external bonding jumper.
 - a. Expansion fitting: Type AX.
 - b. End type expansion fitting: Type EXE.
 - c. Deflection fitting: Type DX.
 - d. Pull box fitting: Type EXPB.
 - e. Combination expansion/deflection fitting: Type AXDX.
- G. Conduit fittings for Hazardous (Classified) Locations: Comply with UL 886.
- H. PVC-Coated Steel Conduit: Comply with NEMA RN 1 and ETL PVC-001; PVC-coated RSC or IMC with 0.040 inch (1 mm), minimum coating thickness.
- I. Coating for fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch(1 mm), with overlapping sleeves protecting threaded joints. J. EMT: ANSI C80.3 and UL 797.
- K. Fittings for EMT:
 - 1. Steel, set-screw couplings.
 - 2. Steel, set-screw insulated throat box connectors with molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside box or cabinet.
 - 3. Steel, set-screw insulated throat box connectors with thermoplastic insulated grounding bushing on all tubing where grounding bushings are required.
 - 4. Expansion joints: O-Z/Gedney, type TX or acceptable submission, with internal ground and external bonding jumper.
 - 5. Insulated throat material for fittings to be of a color that is easily distinguishable; clear thermoplastic throats are not acceptable.
- L. FMC: Comply with UL 1; Zinc-coated steel
- M. LFMC: Comply with UL 360; Flexible steel conduit with neoprene jacket and copper grounding strand.
- N. Fittings for FMC and LFMC: Comply with NEMA FB 1 and UL 514B.
 - a. Adapters at connections between flexible and rigid conduit.
 - b. Thermoplastic insulated throat, steel connectors at box or cabinet terminations.
 - c. Insulated throat material for fittings to be of a color that is easily distinguishable; clear thermoplastic throats are not acceptable.

- O. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
- P. Wire Support Bushings: Provide for vertical runs as required by the NFPA 70. Select for the conductor size involved.
 - 1. For conductors NO. 8 AWG and smaller provide galvanized, non-insulating type.
 - 2. For conductors No. 6 AWG and larger provide O-Z/Gedney, Type SR, insulating type.
- Q. Joint Compound for RSC, RAC or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.
- R. The use of MC Cable is not allowed.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Mono-Systems, Inc.
 - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, type and sized according to NFPA 70 as required.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 870.
- D. Fittings and Accessories:
 - 1. Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - 2. Construct wireways with/without knockouts, as required.
 - 3. Provide spring nuts or guards on all screws installed toward the inside to prevent wire insulation damage.
- E. Wireway Covers:
 - 1. Hinged type unless access restrictions require screw-cover type.
 - 2. Flanged-and-gasketed as required for NEMA type.
 - 3. Construct cover to close without the use of parts other than the standard lengths, fittings, and connectors.
 - 4. Provide provisions for the cover to be sealed in the closed position with a sealing wire.

- F. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers, complying with UL 5. Prime coating, ready for field painting.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. MonoSystems, Inc.
 - c. Panduit Corp.
 - d. Wiremold / Legrand.
- C. Surface raceways used together with couplings, clips, bushings, straps, connectors, connection covers, elbows, boxes, extension boxes, fixture boxes, extension adapters, blank covers and all other required fittings; size to accommodate the conductors to be installed therein in each case.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a brand of Pentair Equipment Protection.
 - 7. Hubbell Incorporated.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. MonoSystems, Inc.
 - 11. Oldcastle Enclosure Solutions.
 - 12. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
 - 13. RACO; Hubbell.
 - 14. Robroy Industries.
 - 15. Spring City Electrical Manufacturing Company.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
 - 1. Material: Cast or sheet metal.
 - 2. Type: Fully adjustable or semi-adjustable.
 - 3. Shape: Rectangular or as indicated.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Sheet Metal Pull and Junction Boxes: Comply with NEMA OS 1.
 - 1. Construct boxes from code gauge sheet steel no lighter than 14 gauge with overlapped riveted or welded corners and with edges turned to receive trim.
 - 2. Construct covers from same gauge as box with screw fasteners. Sectionalize boxes over 864 square inches.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Gangable boxes are allowed, except for receptacles in patient care area.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, with continuous hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- N. Cabinets:
 - 1. Comply with NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 1. Above Ground: RAC, RSC, or IMC.
 2. Within Crawl Spaces: RAC, RSC, or IMC.
 3. Emergency Feeders: RSC
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, unless otherwise indicated.
- B. Comply with the following indoor applications, unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Physical Damage: RSC, or IMC. Includes, but is not limited to, raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 3. Conductors over 600 volts: RAC, RSC, or IMC.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Concealed within Masonry Walls: RAC, RSC, or IMC.
 6. Concealed under Raised Floors: EMT or LFMC.
 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 8. Damp or Wet Locations: RSC, or IMC.
 9. Elevator Pits: RSC, IMC, or LFMC.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in institutional and commercial kitchens and damp or wet locations.
 11. Emergency feeders and branch circuits: EMT.
 12. Corrosive Locations: PVC-Coated RSC, PVC-Coated Steel Conduit.
- C. Minimum Raceway Size:
 1. Individual Branch Circuits: 1/2-inch.
 2. For feeder circuits and multiple branch circuits: 3/4-inch.
- D. Provide minimum 1/2"-inch(16-mm) conduit for controls circuiting.
- E. Magnetic Resonance Imaging (MRI) Environments: Provide aluminum raceways within RF shielding.
- F. Use the shortest path possible to the intended load or receptacle for raceways of ungrounded circuits which are electrically monitored by ground detector system; this is intended to minimize leakage current to ground. In ceiling space, utilize paths that deviate from that perpendicular to structure where these paths will not interfere with other overhead systems.

- G. Junction and Pull Boxes: Sheet steel boxes, unless otherwise indicated.
 - 1. Provide boxes no smaller than 4 inches square and 2-1/8 inches deep.
 - 2. Size all junction and pull boxes in accordance with the NFPA 70, unless project conditions dictate use of larger boxes.
 - 3. Boxes in Hazardous Areas: Cast metal boxes with appropriate sealing fittings.
- H. Outlet and Device Boxes: Sheet steel boxes, unless otherwise indicated.
 - 1. For Lighting Fixture Outlets: 4 inch square with raised fixture ring.
 - 2. For Wall Switches, Receptacles, and Communication Use: 4 inch square, onepiece. Use boxes with plaster rings in all plastered walls where wall thickness permits. Use boxes 1-1/2 inch deep only in locations where deep boxes cannot be accommodated by construction.
 - 3. Boxes in Hazardous Areas: Cast metal boxes with appropriate sealing fittings.
- I. Boxes Used Outdoors or in Damp/Wet Locations: Cast metal boxes with gasketed covers and threaded hubs.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Comply with FM Global Property Loss Prevention data sheets for flood proofing. Permanently seal with water-resistant materials all penetrations into the building. This includes wall penetrations into electrical panels. Install watertight covers on all floor mounted cable trenches.
- C. Store conduit in dry locations during construction. Swab conduits out prior to pulling conductors.
- D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel, unless intumescent putty pads are installed according to Division 07 Section "Penetration Firestopping."
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- G. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- H. Set metal floor boxes level and flush with finished floor surface.
- I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

- J. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- K. Recessed Boxes in Fire-Rated Partitions: For boxes located on opposite sides of same partition do not install boxes back-to-back; separate boxes with a minimum of 24 inch separation, unless otherwise indicated in the installation requirements specified in Division 07 Section "Penetration Firestopping."
- L. Recessed Boxes in partitions around Acoustically-Sensitive Spaces: For boxes located on opposite sides of same partition do not install boxes back-to-back; separate boxes with a minimum of 24 inch separation. Acoustically-Sensitive Spaces include, but are not limited to, the following:
 - 1. Conference Rooms, Meeting rooms and similar spaces.
 - 2. Classrooms, Training Rooms and similar spaces.
 - 3. Interview Rooms, Consultation Rooms and similar spaces.
 - 4. Auditoriums, Lecture Rooms, and similar spaces.
 - 5. Ballrooms, Private Dining, and similar spaces.
 - 6. Other spaces specifically listed in the Project Acoustic Consultants' recommendation reports or specifications.
- M. On concealed conduit systems where boxes are not otherwise accessible, set boxes flush with finished surfaces for access, and provide overlapping covers.
- N. Provide boxes where shown and where necessary for the installation and pulling of cables and wires.
- O. Install covers on junction boxes and conduit bodies after wiring and connections are completed.
- P. Install raceways perpendicular or parallel to building surfaces with boxes set plumb and square. In areas where there are no suspended ceilings, run all conduits parallel and perpendicular to building surface planes.
- Q. Install conduits to prevent excessive strain or damage to conductors.
- R. Run conductors over 48 Volts in raceway, unless otherwise indicated.
- S. Where raceways are installed running parallel with flues, steam pipes, hot-water pipes, and other objects operating at high temperatures, maintain a minimum of 6 inches (150 mm) between raceway and pipe insulation or jacket.
- T. Where raceways cross hot water and steam piping, maintain a minimum of 1-inch (25.4mm) between raceway and pipe insulation or jacket. Install horizontal raceway runs above water and steam piping.
- U. Complete raceway installation before starting conductor installation.
- V. Support raceways and boxes as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

- W. Conceal conduit within finished walls, ceilings, and raised floors, unless otherwise indicated.
- X. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
 - 1. Change from ENT to RAC, RSC, or IMC before rising above the floor.
- Y. No feeders or branch circuits are to be installed in any slab, unless otherwise indicated.
- Z. No branch circuits are to be installed below slab-on-grade, unless otherwise indicated.
Exception: On-grade floor boxes, route raceway minimum of 6 inches below slab-on-grade.
- AA. Do not install aluminum conduits in contact with concrete.
- BB. Install no more than the equivalent of three 90-degree bends and a maximum of 150 feet between pull points in any conduit run except for communications conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- CC. Join RAC, RSC and IMC with threaded couplings. Ream conduits after threading and keep each end closed.
- DD. Join EMT with the specified type of couplings. At EMT terminations, provide insulated throat, box connectors and locknuts.
- EE. Provide insulating bushing at conduit box terminations. Provide bonding clamps where grounding bushings are required.
- FF. Secure rigid conduits at cabinets and boxes with galvanized locknuts, both inside and outside.
- GG. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- HH. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- II. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- JJ. Install raceways to avoid moisture traps. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate

having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. In damp or wet locations.
4. Where otherwise required by NFPA 70.

KK. Install raceways and cables as to not hinder access to ceiling space through access hatches. Maintain 36" minimum clearance and required clearance to equipment above ceiling access hatches.

LL. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

MM. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

NN. Flexible Conduit Connections: Comply with NEMA RV 3.

1. Use minimum of 12 inches (305 mm) and a maximum of 72 inches (1830 mm) at final connections to equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
2. Use LFMC in damp or wet locations including mechanical equipment rooms, at motor or equipment locations at or near pumps, and when installed outdoors.

OO. Where raceways do not terminate in a box or cabinet, install thermoplastic insulating bushings on end of raceway to protect future cabling from physical damage.

- PP. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- QQ. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- RR. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- SS. Install pull wires free of splices in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Coil and identify each end of each line with plastic tag bearing complete information as to the purpose of the raceway and the location of its other end.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 26 Section "Common Work Results for Electrical."

3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CONNECTIONS

- A. Ground raceways and boxes according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Identify raceways and boxes as specified in Division 26 Section "Identification for Electrical Systems".

3.8 SEGREGATION OF WIRING SYSTEMS

- A. Segregation of wiring systems shall not be compromised by the use of common pullboxes, wireways, cabinets or any other type of enclosure.
- B. The raceway system for each feeder shall be a separate system completely fault isolated from all other raceway systems.
- C. The raceway system for the branch circuits of each panelboard shall be a separate system completely fault isolated from all other raceway systems.
- D. In systems operating at more than 300 volts between phase conductors, and where different phase conductors are to be run to a common device or outlet box, provide code gauge barrier equal to box gauge between conductors so that two different phase wires will not be in the same compartment.
- E. Normal, Life Safety, Critical, and Equipment branch wiring shall not share conduits, pullboxes, wireways, cabinets, or any other type of raceway or enclosure.

3.9 CLEANING

- A. On completion of raceway installation but before any cable is installed, perform the following:
 - 1. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. On completion of box, enclosure, and cabinet installation but before any cable or wiring devices are installed, inspect interior of boxes and perform the following: 1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceways.
 - 2. Identification for conductors and multi-conductor cables.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for engraved wall plates and wiring device identification requirements.

1.2 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 – PRODUCTS.
- B. Product Data: For each electrical identification product indicated.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- D. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Brass or Stainless Steel Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or Stainless Steel, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

2.2 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for interior application.
 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for exterior application.
 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 3. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR ## INCHES." Verify work space required for specific project conditions with NFPA 70 and replace "##" in previous sentence with appropriate distance.
 3. Arc Flash Warning and Instructions: "WARNING - ARC FLASH AND SHOCK HAZARD. WEAR APPROPRIATE PPE. Determine appropriate protective clothing and personal protective equipment (PPE) for the task from NFPA 70E."
 4. Provide detailed labeling in accordance with requirements listed in Division 26 Section "Overcurrent Protective Device Coordination Study".

2.4 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label with white lettering. Punched or drilled for screw mounting. Minimum letter height shall be 1/2 inch.
1. Provide the following color coded nameplates:
 - a. Power Circuits:
 - 1) Normal: White lettering on Green background.
 - 2) Emergency Legally Required Standby or Essential Electrical System prior to ATS: White lettering on Red background.
 - 3) Life Safety Branch: Black lettering on Yellow background.
 - 4) Critical Branch: Black lettering on Orange background.
 - 5) Equipment Emergency System: Black lettering on White background.
 - 6) UPS: Black lettering on Tan background.
 - b. Fire Alarm System: White lettering on Red background.

- c. Fire-Suppression Supervisory and Control System: Yellow lettering on Red background.
- d. Combined Fire Alarm and Security System: Red lettering on Blue background.
- e. Security System: Black lettering on Orange background.
- f. Mechanical and Electrical Supervisory System: Green lettering on Blue background.
- g. Telecommunication System: White lettering on Blue background.
- h. Control Wiring: Black Lettering on Yellow Background
- i. Nurse Call: White lettering on Purple background
- j. Public Address / Intercom: White lettering on Black background
- k. CATV / MATV: White lettering on Magenta background
- l. Clock: White lettering on Black background

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Conductor Color-Coding Key: Engraved, Laminated Acrylic, Melamine Label, or DecalStyle Label: Adhesive, Punched, or drilled for screw mounting. Minimum letter height shall be 3/8 inch (10 mm). Key to describe the conductor color coding scheme used in building in accordance with NFPA 70.

2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F ((23 deg C)), According to ASTM D 638: 7000 psi (48.2 MPa).
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: Black.
- D. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
 - 1. Exterior Ferrous Metal:

- a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 - 2. Exterior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 - 3. Interior Ferrous Metal:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior ferrous-metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 - 4. Interior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior zinc-coated metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
- E. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. Conductor Color-Coding Key: Install Instructional Label denoting the conductor colorcoding scheme on all panelboards, distribution boards, switchboards, switchgear, motorcontrol center and similar equipment.
- H. Conductor Color-Coding for Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied to conductors or for sizes larger than No. 8 AWG, if authorities having jurisdiction permit, field applied.
 - 2. Colors for Grounding Conductors:
 - a. Equipment Grounding Conductor: Green.
 - b. Isolated Equipment Grounding Conductor: Green with Yellow Stripe.
 - 3. Colors for 208/120-V Wye Systems:
 - a. Phase A: Black.

- b. Phase B: Red.
- c. Phase C: Blue.
- d. Grounded Conductor (Neutral): White

4. Colors for 480/277-V Wye Systems:

- a. Phase A: Brown.
- b. Phase B: Orange.
- c. Phase C: Yellow.
- d. Grounded Conductor (Neutral): Gray

5. Colors for Ungrounded Systems: Comply with applicable paragraphs of the current editions of NFPA 70 and NFPA 99.

- a. Conductor 1: Orange with a distinctive colored stripe other than white, green, or gray
- b. Conductor 2: Brown with a distinctive colored stripe other than white, green, or gray
- c. Conductor 3 (for three phase systems): yellow with a distinctive colored stripe other

6. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- J. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- K. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- L. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Multi-Conductor Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.
- C. Power-Circuit Conductor Identification, 600V or Less: Identify source and circuit number of each ungrounded conductor or set of conductors. For single conductor cables, identify phase in addition to the above.
 - 1. For conductors in pull and junction boxes, device boxes, and within 6-inches (153 mm) of termination use pre-printed marker tape.

2. For conductors in vaults, manholes, hand holes and pull and junction boxes located in damp or wet locations use brass or stainless steel wraparound marker labels.
- D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Main-Tie-Main Switchboards
 - c. Generator Paralleling Switchgear.
 - d. Controls with external control power connections.
 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
 3. Arc Flash Warning Labels: Apply label to door or cover at all access point of equipment including, but not limited to, the following:
 - a. Disconnect switches.
 - b. Electrical substations.
 - c. Electrical switchgear and switchboards.
 - d. Emergency system boxes and enclosures.
 - e. Enclosed circuit breakers.
 - f. Meter Sockets and assemblies.
 - g. Motor starters.
 - h. Motor-control centers.
 - i. Panelboards.
 - j. Power transfer equipment.(ATS)
 - k. Transformers.

I. Uninterruptible power supply equipment.

I. Junction Boxes:

1. Provide panel and circuit identification numbers on outside cover of junction boxes using permanent marking pen neatly handwritten. Note: Circuit number identification should match wire identification contained therein.
2. Paint fire alarm system junction boxes and sleeves: red.
3. Paint Critical branch junction boxes and sleeves: orange.
4. Paint Life Safety branch junction boxes and sleeves: yellow.
5. Equipment branch junction boxes and sleeves: Not painted.
6. Normal power junction boxes and sleeves: Not painted.
7. Security System junction boxes and sleeves: Orange
8. Nurse Call System junction boxes and sleeves: Purple
9. AV System junction boxes and sleeves: Black
10. Telephone System junction boxes and sleeves: White
11. Data System junction boxes and sleeves: Blue

J. Low Voltage System Wiring: Provide color coded wiring for all low voltage systems in accordance with OLOL standards.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer, load shedding, Kirk Key Controlled Breakers.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 3 lines of text or more are required, use label height as required to accommodate 3/8-inch- (9.5-mm-) high letters.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label drilled and attached with corrosion-resistant screws.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor per ANSI A13.1.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Distribution Equipment with Overcurrent Protective Devices to be labeled:
 - a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name, voltage, origination of service, branch, and amps rated interrupting. Table 2 below lists typical

examples of label format, coordinate project specific requirements with Drawings:

- 1) Electrical switchgear and switchboards.
- 2) Panelboards.
- 3) Electrical substations.
- 4) Motor-control centers.
- 5) Enclosed switches.
- 6) Enclosed circuit breakers.

Table 2 (Examples Only)

EMERGENCY SYSTEM 'EMSA' 480Y/277V FED FROM 'GEN-1' RATED INTERRUPTING: XX,XXXA	<i>NORMAL</i> '1DPHA' 480Y/277V <i>FED FROM</i> 'MSA' RATED INTERRUPTING: XX,XXXA	LIFE SAFETY BRANCH '1LSHA' 480Y/277V FED FROM 'DPLSHA' RATED INTERRUPTING: XX,XXXA
EQUIPMENT SYSTEM '1EQLA' 208Y/120V FED FROM 'T1EQLA' RATED INTERRUPTING: XX,XXXA	<i>CRITICAL BRANCH</i> '1CRHA' 480Y/277V <i>FED FROM 'ATS- CR' RATED</i> INTERRUPTING: XX,XXXA	<i>NON-ESSENTIAL</i> '1DPCH-N' 480Y/277V <i>FED FROM</i> 'ATS-N' RATED INTERRUPTING: XX,XXXA
NORMAL 'CHP-1' 480Y/277V FED FROM 'MCC-1' RATED INTERRUPTING: XX,XXXA	NORMAL 'AHU-1' 480Y/277V FED FROM '1DPHA' RATED INTERRUPTING: XX,XXXA	<i>EQUIPMENT SYSTEM</i> 'HWP-1' 480Y/277V <i>FED FROM</i> 'CPEQHA' RATED INTERRUPTING: XX,XXXA

3. Distribution Equipment without Overcurrent Protective Devices to be labeled:

- a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name, voltage, origination of service, and branch. Table 3 below lists typical examples of label format, coordinate project specific requirements with Drawings:

- 1) Electrical cabinets, and enclosures.
- 2) Enclosed Bus Assemblies.
- 3) Transformers: Label that includes tag designation for the transformer, feed, and panelboards or equipment supplied by the secondary.
- 4) Disconnect switches.
- 5) Emergency system boxes and enclosures.
- 6) Enclosed controllers.
- 7) Variable-speed controllers.

- 8) Push-button stations.
- 9) Power transfer equipment (ATS) – Label both sources.
- 10) Auxiliary Equipment (SPD, Capacitor Banks, etc.).
- 11) Contactors.
- 12) Fire-alarm control panel and annunciators.

Table 3 (Examples Only)

<i>CRITICAL BRANCH 'T2CLA' 75 KVA, 480V to 208Y/120V FED FROM '2CHA' FEEDS '2CRLA'</i>	<i>EQUIPMENT SYSTEM 'ATS EQ' 480Y/277V FED FROM 'MSA' NORMAL FED FROM 'EMSA' EMERGENCY FEEDS '1EQHA'</i>	<i>OPTIONAL STANDBY SYSTEM 'ATS SS' 480Y/277V FED FROM 'MSA' NORMAL FED FROM 'EMSA' EMERGENCY FEEDS '1SSHA'</i>

4. Other Equipment to be labeled:
 - a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name.
 - 1) Access doors and panels for concealed electrical items.
 - 2) Remote-controlled switches, dimmer modules, and control devices.
 - 3) Power-generating units, including remote emergency stop switches.
 - 4) Voice and data cable terminal equipment.
 - 5) Master clock and program equipment.
 - 6) Intercommunication and call system master and staff stations.
 - 7) Television/audio components, racks, and controls.
 - 8) Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - 9) Monitoring and control equipment.
 - 10) Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
5. Provide for each feeder overcurrent protective device in each switchgear, switchboard, distribution panelboard, motor control center, and any other similar equipment furnished under this Division, identification as to the specific load that it serves.
6. Provide for each 3 phase motor: brass phase rotation tags securely attached to the equipment.

END OF SECTION

SECTION 26 0573

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for computer-based, fault-current and overcurrent protective device coordination studies and arc flash protection study. Protective devices shall be set based on Engineer's review of submitted results of the protective device coordination study.
 - 1. Coordination of series-rated devices is not permitted.
 - 2. Delegated Design Requirements for Arc Flash Hazard Analysis.

1.2 PERFORMANCE REQUIREMENTS

- A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of normal and emergency power to 0.10 seconds.
- B. Delegated Design for Arc Flash Hazard Analysis: Prepare computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

- A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- C. SCCR: Short-circuit current rating.
- D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 – PRODUCTS

- B. Simultaneous Action Submittals: The following action submittals shall be made in conjunction with the approval process for system protective devices specified in other Division 26 Sections. The release of electrical equipment submittals (panelboards, engine generators, switchgear, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study. The Architect and Engineer require a full submittal review period as delineated in Division 01 Section "Submittal Procedures" to adequately review the OCPD study against the submitted electrical components prior to release of submittals for equipment procurement. The submittal schedule required by Division 01 requirements shall provide for this review time in the action submittal process. Delay claims arising due to Contractor's failure to coordinate simultaneous action submittals will not be considered by the Owner. The following submittals shall be in digital form:
 - 1. Coordination-study input data, including completed computer program input data sheets. Provide editable electronic media including all SKM (and/or Easypower) files and breaker TCC's.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report.
 - 4. Arc-flash study input data, including completed computer program input data sheets.
 - 5. Arc Flash Hazard Analysis Report.
- C. Product Data: For computer software program to be used for studies.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Coordination Study Specialist and Arc-Flash Hazard Analysis Specialist.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399. For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - a. The following parts from the Protective Device Coordination Study Report:
 - 1) One-line diagram.
 - 2) Protective device coordination study.
 - 3) Time-current coordination curves.
 - 4) Coordination setting schedules.
 - b. Power system data.
- B. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

- C. Operation and Maintenance Procedures: In addition to items specified in Division 01 Section "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Delegated Design System Study Specialist Qualifications: Comprehensive engineering analysis by a qualified Professional Engineer or personnel trained and employed by the equipment manufacturer in required calculation methodology.
- D. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- E. Comply with IEEE 399 for general study procedures.
- F. Comply with IEEE 1584 for performing Arc Flash Hazard Calculations.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by the following:
 - 1. SKM Systems Analysis, Inc.
 - 2. Easy Power

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 242 and IEEE 399 for fault-current and overcurrent protective device coordination studies.
- B. Comply with IEEE 1584 and NFPA 70E for arc-flash hazard analysis.
- C. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current characteristic curves as part of its output. Computer software program shall

report device settings and ratings of all overcurrent protective devices and shall demonstrate coordination by computer-generated, time-current coordination plots.

2.3 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive Summary
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center and panelboard designations.
- D. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.
- E. Short-Circuit Study Output:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

2.4 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

- A. Executive summary.
- B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
- C. Study Input Data: As described in "Power System Data" Article.
- D. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article above.

E. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.
 - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.
 - b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.

F. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Medium-voltage equipment overcurrent relays.
 - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e. Transformer full-load current, magnetizing inrush current, and ANSI throughfault protection curves.
 - f. Cables and conductors damage curves.
 - g. Ground-fault protective devices.
 - h. Motor-starting characteristics and motor damage points.
 - i. Generator short-circuit decrement curve and generator damage point.
 - j. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Provide adequate time margins between device characteristics such that selective operation is achieved.
6. Comments and recommendations for system improvements.

2.5 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article above.

F. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

- H. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout. I. Equipment specific Arc Flash Warning Labels.

2.6 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.
- B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1. Flash Hazard Boundary
 - 2. Short Circuit Current Available
 - 3. Shock Hazard when Cover is Removed
 - 4. Limited Approach Boundary
 - 5. Restricted Approach Boundary
 - 6. Prohibited Approach Boundary
 - 7. PPE Requirements, including the following:
 - a. Hazard Risk Category
 - b. Required Minimum Arc Rating of PPE in cal/cm²
 - c. Clothing Description
 - 8. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.
 - 1. Proceed with coordination study and arc-flash study only after relevant equipment submittals have been assembled, but prior to their submission to the Architect.
 - a. Coordination study shall accompany submission of relevant equipment submittals.
 - b. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 POWER SYSTEM DATA

- A. Delegated Design System Analyst performing the short-circuit, protective device coordination study, and arc flash hazard analysis shall furnish the Contractor with a list of required data immediately after award of the contract. Contractor shall expedite collection of the data to ensure completion of the study and analysis as required.

- B. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
- C. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.
 - 1. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field.
 - 2. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or electrical contractor. Contractor shall include all costs in bid to collect all information required to complete the study.
- D. Source combination shall include present motors and generators.
- E. If applicable, include fault contribution of existing motors in the study and analysis.
- F. Gather and tabulate the following input data to support coordination study:
 - 1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Electrical Distribution System Diagram: In electronic-copy formats, showing the following:
 - a. Circuit breakers and fuses ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, X/R ratios, taps measured in per cent, and phase shift.
 - d. Generator short-circuit current contribution data, including short-circuit reactance, rated kilovolt amperes, size, rated voltage, and X/R ratio.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Busway ampacity, impedance, lengths, and conductor material.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
 - h. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
 - i. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
 - 3. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.

- e. Ratings, types, and settings of utility company's overcurrent protective devices.
- f. Time-current-characteristic curves of devices.
- g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

- A. A short-circuit current ratings indicated in the Contract Documents are based on FaultCurrent study prepared by the Engineer during design and are based on available information and anticipated feeder lengths. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system based on proposed feeder routing. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Electric Utility's supply termination point.
 - 1. Service Entrance Equipment.
 - 2. Switchgear and switchboard bus.
 - 3. Motor-control center.
 - 4. Distribution panelboard.
 - 5. Branch circuit panelboard.
 - 6. Standby Generators and Transfer Switches.
 - 7. Enclosed Fused Switch.
 - 8. Enclosed Circuit Breaker.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculate short-circuit currents according to IEEE 551.
- E. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
 - 1. Transformers, as appropriate for transformers included in the Work:
 - a. ANSI C57.12.10.
 - b. ANSI C57.12.22.
 - c. ANSI C57.12.40.
 - d. IEEE C57.12.00.
 - e. IEEE C57.96.

2. Medium-Voltage Circuit Breakers: IEEE C37.010.
3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
4. Low-Voltage Fuses: IEEE C37.46.

F. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

G. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. Notify Engineer, in writing, of any existing circuit protective devices improperly rated for the calculated available fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 - 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 - 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate on log-log scale graphs, with no more than five devices indicated on any plot that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Electric Utility's overcurrent protective device.
 - b. Device tag.
 - c. Voltage and current ratio for curves.
 - d. Three-phase and single-phase damage points for each transformer.
 - e. No damage, melting, and clearing curves for fuses.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
 - h. Motor starting characteristics, damage points and overload relay.
 - i. Thermal damage curve for motors larger than 100 HP.
 - j. Generator short-circuit decrement curve and damage point, and thermal damage curve.
- F. Completed data sheets for setting of overcurrent protective devices.
- G. Complete Schedule of breaker settings to summarize information contained on data sheets. Sample schedule has been included at the end of this section for preferred format.

3.5 ARC FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system where work could be performed on energized parts including, but not limited to, the following:
 - 1. Disconnect switches.
 - 2. Electrical switchgear and switchboards.
 - 3. Emergency system boxes and enclosures.
 - 4. Enclosed circuit breakers.
 - 5. Motor starter.
 - 6. Motor-control centers.
 - 7. Panelboards.

8. Power transfer equipment. (ATS)
 9. Transformers.
 10. Uninterruptible power supply equipment.
- C. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent protection relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- D. Calculate the arc-flash protection boundary and the corresponding incident energy calculations for multiple system scenarios to be compared and the greatest incident energy to be uniquely reported for each equipment location. Calculations to be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions.
1. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off).
 2. The maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- E. Incident energy calculations shall consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators to be decremented as follows:
1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible.
- F. For each equipment location with a separately enclosed main device, calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
1. When performing incident energy calculations on the line side of a main breaker, the line side and load side contributions must be included in the fault calculation.
- G. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device to compute the incident energy for the corresponding location.
- H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash even, a maximum clearing time based on the specific location shall be utilized.
- I. Complete Arc Flash report to be used for the preparation of Arc Flash Warning labels for electrical equipment. Refer to Division 26 Section "Identification for Electrical Systems" for requirements of Arc Flash Study and labels.

3.6 CORRECT DEFICIENCIES, RE-CALCULATE AND REPORT:

- A. After Engineer's initial review, correct unsatisfactory conditions and recalculate to demonstrate compliance; resubmit overcurrent protective devices as required to bring system into compliance.
- B. Revise and Resubmit report multiple times as necessary to demonstrate compliance with requirements.
- C. Include an allowance of \$25,000 for any required breaker/panelboard changes required due to the study. Provide credit back to the owner for all dollars not spent on breaker/panelboard changes due to the study requirements.

3.7 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels as specified in Division 26 Section "Identification for Electrical Systems". Install labels under the direct supervision and control of the Arc-Flash Hazard Study Specialist.

END OF SECTION

SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Photoelectric switches.
 - 2. Standalone daylight-harvesting switching controls.
 - 3. Indoor occupancy sensors.
 - 4. Lighting contactors.
 - 5. Emergency shunt relays.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for wall-box dimmers, manual light switches, and timer wall-switches.

1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: These specifications and the accompanying Drawings define the intent of the lighting control system to be provided. The switches, sensors, control stations and switching group designations shown on the Drawings define how lighting should be grouped for control. Provide the necessary quantity and type of distributed control products necessary to achieve the design intent. In addition to the system as specified herein and shown on the Drawings, provide all planning, design, calculations, equipment, devices, cabling, system programming and any other component or service required for a complete, fully operational and code compliant system.

1.4 ACTION SUBMITTALS

Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

- A. Product Data: For control modules, power distribution components, control network materials, manual switches and plates, and conductors and cables.
- B. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.
- C. Delegated-Design Shop Drawings: Prepared by factory or authorized representative; based on devices proposed for inclusion in the Work. Include detail assemblies of standard components, custom assembled for specific application on this Project.

1. Floor Plans: showing all control stations, control devices, input devices, cabling, power sources, and other necessary equipment and components.
 2. Control Station Legend: annotated to describe which stations shown in the Product Data are places at keyed locations.
 3. Scene Schedules: schedule for each unique room type with scene descriptions.
 4. System Riser: showing all components with their location labeled.
 5. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 7. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
 8. Interconnection diagrams showing field-installed wiring.
 9. Dimensioned locations of occupancy and light-level sensors.
 10. Coverage patterns for occupancy and light-level sensors.
 11. Include diagrams for power, signal, and control wiring.
- D. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 26 Section "Common Work Results for Electrical".
- E. Product Certificates: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting control device, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
1. Manufacturer's written instructions for adjusting devices after installation.

1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including but not limited to luminaires, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Intelligent Lighting Controls
 - 3. NSi Industries LLC; TORK Products.
 - 4. Square D.
 - 5. Tyco Electronics.
- B. Description: Solid state, with SPST or DPST dry contacts as required, rated for 1800-VA tungsten or 1000-VA inductive to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off. Photocell may be integral with sensor.
 - 3. Time Delay: Fifteen second minimum, to prevent false operation.
 - 4. Surge Protection: Metal-oxide varistor.
 - 5. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 DAYLIGHT-HARVESTING SWITCHING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Intelligent Lighting Controls
- B. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack mounted on luminaire (where indicated), to detect changes in indoor lighting levels that are perceived by the eye.
- C. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 - 3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
 - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 5. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lux), with an adjustment for turn-on and turn-off levels within that range.

6. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc (1080 to 10 800 lux), with an adjustment for turn-on and turn-off levels within that range.
7. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lux), with an adjustment for turn-on and turn-off levels within that range.
8. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
9. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
10. Test Mode: User selectable, overriding programmed time delay to allow settings check.
11. Control Load Status: User selectable to confirm that load wiring is correct.
12. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc.
 2. Intelligent Lighting Controls.
- B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
 1. Lighting control set point is based on two lighting conditions:
 - a. When no daylight is present (target level).
 - b. When significant daylight is present.
 2. System programming is done with two hand-held, remote-control tools.
 - a. Initial setup tool.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
 3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
 4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.4 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc.

2. Intelligent Lighting Controls
- B. General Requirements for Sensors: Wall- or ceiling-mounting, solid-state indoor occupancy sensors with a power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the power pack.
 3. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24V ac/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 (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: Digital display, to show when motion is being detected during testing and normal operation of the sensor.
 6. Detector Coverage: Occupancy sensor system shall cover the entire room or space served. Manufacturer selected for inclusion in the Work shall produce Delegated Design Shop Drawings with device layout and adjust sensor types or quantities as required by their specific products to provide complete coverage. Additional costs will not be considered for adjustments or device additions to meet performance requirements.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
- D. Ultrasonic Type: Ceiling mounting; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
1. Comply with NEMA Standard LC 1-2007 "Test Procedures for Compatibility of Hearing Aids and Ultrasonic Lighting Control Devices".
 2. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
- E. Dual-Technology Type: Ceiling mounting; detect occupants in coverage area using PIR and ultra-sonic detection methods. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Comply with NEMA Standard LC 1-2007 "Test Procedures for Compatibility of Hearing Aids and Ultrasonic Lighting Control Devices".
 2. Sensitivity Adjustment: Separate for each sensing technology.

3. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Industries, Inc.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Devices that are manufactured for use with modular plug-in connectors shall not be installed.
- D. Wall-Switch Sensor:
 1. Comply with NEMA Standard LC 1-2007 "Test Procedures for Compatibility of Hearing Aids and Ultrasonic Lighting Control Devices".
 2. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area as required by application.
 3. Sensing Technology: Dual technology - PIR and ultrasonic.
 4. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off." Single circuit and dual circuit as required by Drawings.
 5. Voltage: Match the circuit voltage.
 6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
- E. Finishes, including device color, wall plate and lettering: Comply with Division 26 Section "Wiring Devices."
- F. Wall Plates: Comply with wall plate requirements in Division 26 Section "Wiring Devices."

2.6 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bodine.
 2. Intelligent Lighting Controls.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contact as indicated; complying with UL 924.
1. Coil Rating: 120-V or 277-V, as indicated.

2.8 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG or larger if otherwise required by manufacturer. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG or larger if otherwise required by manufacturer. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

2.9 DISTRIBUTED AND INTEGRATED DIGITAL LIGHTING CONTROLS

- A. Where show on drawings, provide complete digital lighting control system by Intelligent Lighting Controls that includes: control panels, digital switches, digital occupancy sensors, relays, cabling, etc. as required for a complete installation. Contractor shall provide full design and documentation of intelligent digital lighting controls system based on locations and information noted on construction drawings. Prior to procurement of equipment, provide detailed drawings showing all components, locations, connections, etc.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- C. Switchbox-mounted sensors:
1. Set field selectable sensors to manual "on" automatic "off" for all devices indicated to be Vacancy sensors on the Drawings. Set all other sensors to field

selectable automatic "on". Comply with IECC 2021 in areas required to comply with IECC 2021.

2. Comply with installation and connection requirements in Division 26 Section "Wiring Devices."

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpowerlimited 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, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 1. Identify controlled circuits in lighting contactors.
 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.
- C. Switchbox-mounted sensors: Comply with identification requirements in Division 26 Section "Wiring Devices."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following field tests and inspections and prepare certified test reports:
 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.

3.6 ADJUSTING

- A. Time-Schedule Adjustments: Times indicated in documents represent initial settings known at time of design documentation. Coordinate final program settings for time-of-day and holiday schedules with Owner prior to Substantial Completion.

When requested within 3 months of date of Substantial Completion, provide on-site assistance in adjust schedules to suit Owner. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.

- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. Reset all adaptive technology and learning devices post-construction.
 - 2. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 3. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.7 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. On completion of device box installation but before any wiring devices are installed, inspect interior of boxes and perform the following:
 - 1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- C. On completion of wall plate installation, inspect exterior surfaces and perform the following:
 - 1. Remove paint splatters and other spots.
 - 2. Replace cracked or damaged wall plates.
 - 3. Wipe down all wall plates with approve cleaning agent to remove fingerprints and dust.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's management and maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training." Provide minimum of 16 hours of owner training at times/dates determined by owner.

END OF SECTION

SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1500 kVA:
 - 1. Distribution transformers.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for stacked transformers, using performance requirements and design criteria indicated.
 - 1. Design equipment supports for stacked transformers capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 ACTION SUBMITTALS

Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
 - 1. Include typical manufacturer's test data reports for each type and size transformer.
 - Reports shall include but not be limited to the following data:
 - a. Maximum Efficiency in accordance with NEMA TP 1.
 - b. Efficiency at 50-percent and 100-percent load.
 - c. Percent voltage regulation at 80-percent and 100-percent power factor.
 - d. Losses in kVA at no load and full load conditions.
 - e. Percent X and Percent R values,
 - f. Maximum sound level of transformer in enclosure (in dBA).
 - g. Maximum 30-Deg hot spot and average temperature rise over a 40 degree C ambient.
- B. Delegated-Design Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
 2. Stacked Transformers Rack: show fabrication and installation details and include calculations for equipment supports.
- C. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical" for each location where transformers are included in the Work. Include the following:
1. Ground rod and grounding cable locations.

1.4 ACTION SUBMITTALS

- A. Source quality-control test reports.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
1. Manufacturer's routine maintenance requirements for transformers and all installed components.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer, unless otherwise indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Prepare equipment for shipment.
1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.
- B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.
1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
 2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

- D. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- E. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.9 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Complying with DOE 2016 Energy Efficiency Levels.
 - 2. Comply with NEMA TP 1 energy-efficiency levels as verified by testing according to NEMA TP 2.
 - 3. K4 Rated
- D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."
- E. Cores: High grade, grain-oriented, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses.
- F. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Aluminum

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with DOE 2016 Energy Efficiency Levels.
 - 2. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 3. Tested according to NEMA TP 2. C. Cores: One leg per phase.
- D. Enclosure for Interior Transformers: Ventilated, NEMA 250, Type 2, unless otherwise indicated.
 - 1. Core and coil shall be impregnated within resin compound, sealing out moisture and air.
- E. Enclosure for Exterior Transformers: Ventilated, NEMA 250, Type 3R, unless otherwise indicated.
 - 1. Core and coil shall be impregnated within resin compound, sealing out moisture and air.
- F. Transformer Enclosure Finish: Comply with NEMA 250. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of a polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces.
 - 1. Finish Color: ANSI Gray.
- G. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- H. Taps for Transformers 7.5 to 14 kVA: Two 5 percent taps below normal full capacity.
- I. Taps for Transformers 15 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- J. Insulation Class: Materials in accordance with NEMA ST20 220 deg C, UL-component recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Construct K-rated transformers in accordance with requirements of Distribution Transformers listed above, unless otherwise indicated.
 - 2. Indicate value of K-factor on transformer nameplate.
 - 3. Taps for Transformers 15 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
 - 4. Neutral Terminal: Rated for 200-percent of secondary phase current.
 - 5. Electrostatic Shielding: Provide electrostatic shield as specified below.
- L. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91, unless otherwise indicated.

1. 9 kVA and below: 37 dBA
2. 10 kVA to 50 kVA: 42 dBA
3. 51 kVA to 150 kVA: 47 dBA
4. 151 kVA to 300 kVA: 52 dBA
5. 301 kVA to 500 kVA: 57 dBA
6. 501 kVA to 700 kVA: 59 dBA
7. 701 kVA to 1000 kVA: 61 dBA

2.4 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Transformer Mounting
 1. 15 kVA or less: Floor mounted or suspended, as indicated.
 2. 30 kVA and 45kVA: floor mounted, rack mounted or suspended, as indicated.
 3. 75 kVA: Floor mounted or rack mounted, as indicated.
 4. Greater than 75 kVA: Floor mounted or rack mounted, unless otherwise indicated.

3.3 INSTALLATION

- A. Comply with NECA 409, "Recommended Practice for Installing and Maintaining Dry-Type Transformers" as published by the National Electrical Contractors Association.
- B. Install and anchor floor-mounted transformers level on concrete bases, 4-inch (100-mm) nominal thickness according to manufacturer's written instructions. Concrete base is specified in Division 26 Section "Hangers and Supports for

Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

- C. Construct steel channel support system for rack-mounted or suspended transformers according to manufacturer's written instruction and requirements of Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Comply with vibration isolation for transformers per requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems"

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Transformer Nameplates: Label each transformer with Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws.
Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

3.5 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Ground transformer before it is energized.
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Provide flexible metal conduit with a minimum 12" to a maximum 24" length for wiring connections to transformer enclosure.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following field tests and inspections and prepare certified test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.2 for dry-type transformers. Certify compliance with test parameters.
 - 2. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.
 - a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each transformer's connections. Remove covers so connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each transformer 11 months after date of Substantial Completion.
 - c. Instruments, Equipment:

- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

B. Correct Deficiencies and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace transformers, conductors, units, and devices as required to bring system into compliance.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Prepare a report that identifies transformer, connection, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

C. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.7 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report listing output voltages and tap settings.

3.8 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. On completion of installation, inspect interior and exterior surfaces and perform the following:
1. Remove paint splatters and other spots.
 2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
 3. Repair exposed surfaces to match original finish.

3.9 PROTECTION

- A. Temporary Heating: Maintain a clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Apply temporary heating as required.
- B. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's management and maintenance personnel to adjust, operate, and maintain transformers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. Provide labor, materials, tools, appliances and miscellaneous accessories for with the switchboard work indicated herein and on the Drawings.
- B. Switchboards shall be Dead Front Circuit Breaker Distribution type, rated NEMA 1 where used indoors, NEMA 3R where used outdoors.

1.02 QUALITY ASSURANCE

- A. Comply with National Electrical Code applicable to wiring methods, construction and installation of switchboards.
- B. Comply with applicable requirements of UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", and Std. 891, "Dead-Front Electrical Switchboards", pertaining to installation of switchboards. Provide switchboard and components that are UL listed and labeled.
- C. Comply with applicable portions of NEMA Stds. Pub. No. PB 2, "Dead-Front Distribution Switchboards"; PB 2.1, "Instructions for Safe Handling, Installation, Operation and Maintenance of Switchboards", and SG 3, "Low-Voltage Power Circuit Breakers", pertaining to switchboard assemblies.

1.03 SUBMITTALS

- A. Provide manufacturer's data on switchboards including, but not limited to, voltages, number of phases, and short-circuit and continuous current ratings. Provide application data for main and branch circuit breakers, sections, main buses, and basic insulation levels.
- B. Include plan and elevation layouts showing overall dimensions and compartment layout with available spaces; conduit entrance locations and requirements; nameplate legends; one-line diagrams; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and interrupting ratings confirming a fully-rated system for all equipment and components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Subject to compliance with the requirements stated herein and on the drawings, provide switchboards as follows:

Square D QED-S Series or equal by EPD

2.02 EQUIPMENT SECTIONS AND COMPONENTS:

- A. Except as otherwise indicated, provide switchboards and components of types, sizes, characteristics, and ratings indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for complete installation.
- B. AC Dead-Front Distribution Switchboards:
 - 1. Provide factory-assembled, dead-front, metal-enclosed, self-supporting secondary power switchboards, of types, sizes, electrical ratings and characteristics indicated, consisting of vertical panel units and circuit breaker assemblies of quantities, ratings and types indicated.
 - 2. Distribution protective devices shall be individual, or group mounted, as shown on the drawings, with all connections accessible from the front. Provide hinged full height wiring gutter doors for quick access wiring terminals. Metal barriers shall be provided between each vertical section to prevent fault communication and accidental contact. Prime and coat switchboards with manufacturer's standard finish and color. Equip units with built-in lifting eyes and yokes; and provide vertical individual panel units, suitable for bolting together at project site.
 - 3. Switchboards shall be set on a channel iron base set level and grouted into a concrete housekeeping pad. See structural drawings for pad size.
 - 4. Switchboards shall have a ground bus consisting of a copper bar run at the bottom of the switchboard for its entire length and shall be rated at not less than 25% of the main bus capacity. The ground bus shall be bonded to each vertical framing member of the switchboard.
 - 5. Provide insulated, full neutral bus connected to the ground bus by a removable link. Neutral bus shall be the equivalent ampacity as the phase bus bars.
 - 6. The bus bars shall be mounted on supports of high impact non-tracking insulating material and shall be braced to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having a maximum of 100,000 RMS symmetrical amperes available. Bus bars shall be provided with suitable phase identification. Distribution sections shall be fully bussed and fully equipped for future breakers, including all connectors and mounting hardware. Vertical and horizontal bus bars shall be fully rated and match the switchboard rating.
 - 7. Bus bars shall be tin plated copper (98% minimum conductivity) and shall be sized for maximum capacity not to exceed 1000 amps per sq. in. of cross-sectional area. All bolted or pressure joints for busses, interconnections, disconnecting devices and external connections to equipment shall be copper with silver-to-silver high-pressure contacts or electro-tinplated aluminum. At fixed contacts, current density shall

not exceed 150 amps. per square in. of cross-section. Provide tin-plated copper or tin-plated aluminum bus and branch connections to switching devices of sufficient capacity to limit rated continuous current operating temperature rise of no greater than 65 deg C above average ambient temperature of 30 deg C; with main bus and tap connections silver-surfaced and bolted tightly according to manufacturer's torquing requirements for maximum conductivity.

8. Circuit breakers shall be molded case, bolt-on type of the size, number and rating indicated on the drawings. Circuit breakers with trip ratings 100 ampere and larger shall have either adjustable or interchangeable trip units (electronic LSI). Main circuit breakers shall include adjustable ground fault circuit interruption if required by code. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Front face of all circuit breakers shall be flush with each other. Tripped indication shall be clearly shown by the breaker handle taking a position between "on" and "off." Circuit breaker interrupting capacity shall be adequate to withstand not less than 100,000 amps .
9. Each switchboard shall include a multifunction meter with direct reading on the front of the board that will indicate amps, volts, KWH, KW, KW demand, KVA, KVA demand, and THD. The meter shall include communications connectivity to owner's BAS system. Provide Cat 6A cabling between meter and building low voltage communication system. Electrical contractor shall coordinate exact requirements with owner prior to submitting product data.
10. Where called for on the drawings, provide metering as required to record loads per IECC 2021 requirements. Provide all low voltage cabling, head end equipment, meters, etc. as required for a complete system. System shall be by Packet Power.
11. In 480/277V systems, provide ground fault protection for circuit breakers sized over 1000 amps per NEC sections 210 and 230. Settings shall be determined by manufacturer and set in field.
12. Provide arc energy reduction system, per NEC requirements, on all breakers 1200A or higher (included breakers adjustable to 1200A or greater).
13. Switchboard sections shall be 36" maximum width. Contact engineer if total width of switchboard will be greater than 12'-0" wide as room size may need to increase.

PART 3 - EXECUTION

3.01 INSTALLATION OF SWITCHBOARDS

- A. Install switchboards as indicated, in accordance with manufacturer's written instructions, with recognized industry practices to ensure that switchboards comply with requirements of NEMA and NEC standards, and applicable portions of NECA's "Standard of Installation".

3.02 GROUNDING:

- A. Provide equipment grounding and bonding to building steel and to cold water system as shown on the drawings.

3.03 ADJUST AND CLEAN:

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.

3.04 FIELD QUALITY CONTROL:

- A. Prior to energization of circuitry, check all accessible connections to manufacturer's torque specifications.
- B. Prior to energization of switchboard, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- C. Subsequent to wire and cable hook-ups, energize switchboard and demonstrate functioning in accordance with requirements.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of panelboard and enclosure work is indicated by drawings and schedules.

1.02 QUALITY ASSURANCE

- A. Comply with National Electrical Code requirements applicable to installation of panelboards, cabinets, and cutout boxes.
- B. Comply with UL requirements pertaining to panelboards, accessories and enclosures. Provide panelboards that are UL listed and labeled.
- C. Comply with applicable NEMA Standards for panelboards.

1.03 SUBMITTALS

- A. Provide manufacturer's data on panelboards to verify compliance with requirements of the drawings and this specification.

PART 2 - PRODUCTS

2.01 PANELBOARDS

- A. Provide panelboards, enclosures and ancillary components of types, sizes, and ratings indicated which comply with manufacturer's standard materials, design and construction in accordance with published product information. Equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated.
- B. Distribution, Lighting and Appliance Panelboards: Provide dead-front safety constructed factory assembled circuit breaker type panelboards in sizes and ratings as indicated. Construct with plated rectangular shaped copper bus bars that are securely mounted and braced. Provide anti-turn solderless pressure type lug connectors approved for copper conductors for connecting feeders. Equip with full-sized neutral bus bar with suitable lugs for circuits requiring neutral connection. Provide circuit breakers in accordance with schedules shown on drawings. Breakers shall be molded case bolt-in type, heavy-duty, quick-make, quick-break, with toggle handles that indicate when tripped. Where multipole breakers are indicated, provide with common trip so that overload on one pole will trip all poles simultaneously. Provide GFCI, AFCI or combination GFCI/AFCI circuit breakers where called for. Provide lugs on neutral bus for each outgoing circuit or feeder required. Provide bare uninsulated grounding bars suitable for bolting to enclosures with suitable

lugs for incoming and outgoing equipment grounding conductors. Load center type panelboards are not acceptable.

- C. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types indicated, code-gage, minimum 16-gage thickness, minimum 20" wide. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed or surface mounting as noted on the drawings.
- D. Panelboard Accessories: Provide panelboard accessories and devices including, but not necessarily limited to circuit breakers as recommended by panelboard manufacturer for ratings and applications indicated.
- E. Panelboards shall be as shown in the following schedule and shall be completely factory assembled. Do not purchase panelboards or cabinets until submittals have been approved.

Branch Circuit Panelboards (120/208 Volt Operation)

Square D NQ

Branch Circuit Panelboards (277/480 Volt Operation)

Square D NF Series

Distribution Panelboards (600 Amp Mains & Larger)

Square D I-Line HC Series

- F. Where a specific interrupting rating is shown on the drawings, panelboards and associated circuit breakers shall be rated for that value as a minimum. Circuit breakers with non-UL listed ratings are not acceptable. Maintaining required interrupting rating through series rating of devices is not acceptable.
- G. All panelboards shall be in a single enclosure. **Double section panelboards are not to be used. If double section panels are sent to jobsite, they shall be returned and replaced at the expense of the manufacturer.**
- H. Panelboard doors shall have a locking latch and shall be keyed alike for the entire project.
- I. Provide OLOL standard breaker locks for all spare circuit breakers (Garvin screw style).
- J. Where surge protective devices are shown on the drawings, provide a SurgeLogic or approved equal surge protection (with surge counter) device mounted internal to the panelboard per manufacturers recommendations. **All panelboards**

connected to the emergency branch system shall have panel mounted surge protective devices(whether shown on drawings or not).

- K. Provide red locks for circuit breakers serving fire alarm circuits. Space Age Electronics ELOCK FA
- L. Provide labeling per electrical drawings details and applicable specification sections.
- M. Provide electronic trip circuit breakers where shown on panelboard schedules and required by the system studies. Submittals will not be stamped acceptable without updated breaker requirements from the system studies. See system study specifications section for allowance to be utilized for any circuit breaker revisions required by the study. For bid purposes, assume that all 3 pole circuit breakers 150A or larger shall be electronic trip type.

PART 3 - EXECUTION

3.01 INSTALLATION OF PANELBOARDS

- A. General: Install panelboards and enclosures in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standard of Installation", and in compliance with recognized industry practices.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque specified in UL Std. 486A.
- C. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.
- D. Provide properly wired electrical connections within enclosures.
- E. Fill out panelboard circuit directory cards upon completion of installation work. Type text, handwriting is not acceptable.
- F. Provide engraved laminated plastic nameplate for each panel – match building standard finishes. See specification section 26 0553 and drawings for details.

3.02 GROUNDING

- A. Provide grounding connections. Tighten connections to comply with tightening torque specified in UL Std. 486A to assure permanent and effective grounds.

3.03 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
- B. Prior to energization check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- C. Prior to energization, check for electrical continuity of circuits, and for short circuits.
- D. After wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

SECTION 26 27 00

ELECTRICAL POWER MONITORING AND METERING SYSTEM

PART 1 — GENERAL

1.01 DESCRIPTION

Provide a complete electrical energy monitoring and metering system using wireless power monitoring devices to measure, monitor, record, and report energy consumption for the entire building and site in strict accordance with IECC 2021 Section C405.12. The system shall disaggregate electrical loads into the required end-use categories and support automatic data communication, long-term storage, and graphical reporting.

1.02 SCOPE

- A. Whole-building and end-use submetering for all electrical energy supplied to the building and associated site (including exterior lighting).
- B. Use Packet Power wireless monitors, current sensors (split-core CTs or Rogowski coils), gateways, and EMX Energy Portal (or approved equivalent integration) as the primary metering and data acquisition platform.
- C. Group circuits logically at main service, distribution switchboards, panelboards, and motor control centers to meet end-use categories while limiting cross-category mixing to ñ5% of any measured load.
- D. Coordinate with the BAS provider.

1.03 APPLICABLE CODES AND STANDARDS

- A. IECC 2021 Section C405.12 (Energy Monitoring).
- B. NEC, IEEE, and local AHJ requirements.

1.04 SUBMITTALS

- A. Shop drawings showing exact monitor locations, CT placements, circuit groupings by end-use category, and wireless network layout.
- B. Product data for all components (monitors, CTs, gateways, software portal) including accuracy ratings (+/-1% for current/power measurements).
- C. Sample graphical reports from Energy Portal demonstrating hourly, daily, monthly, and yearly views for each required category over 36 months.
- D. Integration details with BAS (BACnet).
- E. Operation and maintenance manuals, including wireless network configuration and training materials.

1.05 WARRANTY

Provide warranty on metering equipment (minimum 3 years).

PART 2 — PRODUCTS

2.01 MANUFACTURER

- A. Packet Power. All metering devices shall be Packet Power wireless models unless otherwise noted.

2.02 METERING DEVICES

- A. High-Density Monitors: Packet Power BGS series or High-Density Power Monitors capable of connecting 12-120 current sensors per unit for branch, feeder, and panel-level monitoring.
- B. Single Meters: Packet Power MP277 or MP480 series for main service or larger feeders (1-12 CTs, full power monitoring).
- C. Current Sensors: Split-core CTs or flexible Rogowski coils (15A to 10,000A range) as required for each circuit. Sensors shall provide tested accuracy of +/-1% or better.
- D. Power Measurements: Devices shall measure Volts, Amps, Watts, kWh, power factor, frequency, and other parameters as needed for accurate end-use disaggregation.
- E. Wireless Communication: Proprietary secure mesh network (no individual IP addresses required per sensor). Data transmitted automatically to Ethernet Gateway(s).
- F. Power Supply: Line-powered where possible; monitors shall begin reporting immediately upon energization (plug-and-play).

2.03 DATA ACQUISITION AND REPORTING SYSTEM

- A. Gateway(s): Ethernet Gateway(s) to collect data from all wireless monitors and provide network connectivity.
- B. Software Platform: EMX Energy Portal (cloud or on-premises option) as the central data acquisition system. The platform shall:
 - 1. Automatically collect and store data for a minimum of 36 months.
 - 2. Provide real-time and historical data at hourly (or finer) resolution.
 - 3. Total multiple monitors into the six IECC-required end-use categories (Total HVAC, Interior Lighting, Exterior Lighting, Plug Loads, Process Loads, Building Operations & Miscellaneous).
 - 4. Support export via Modbus TCP, SNMP, BACnet IP, MQTT for 3rd party software integration.
- C. Graphical Reporting Interface: EMX Energy Portal shall deliver a permanent, readily accessible web-based dashboard that graphically displays energy consumption by end-use category for hourly, daily, monthly, and yearly intervals over the previous 36 months.
- D. Software should be available in a local or cloud version.
- E. Any connections required to owners network shall be vetted with owner's IT department. As the time to accomplish this fairly long, contractor shall begin discussions with the owner's IT department as soon as the notice to proceed is given to the contractor. (Provide data cabling and outlets where required).

PART 3 — EXECUTION

3.01 INSTALLATION

- A. Install power monitors and CTs at the main electrical service, distribution equipment, and panelboards as shown on drawings or as required to achieve end-use disaggregation.
- B. CTs shall be installed on the load side of breakers where practical; verify direction and phasing.
- C. Wireless monitors shall form a self-configuring, self-optimizing mesh network with Ethernet Gateway(s) located for reliable coverage.
- D. Minimize wiring; no data communication cabling required between monitors and gateway.
- E. Label all metering points clearly for future maintenance.

3.02 COORDINATION

- A. Coordinate monitor and CT placement prior to equipment installation to avoid conflicts.
- B. Integrate with the building automation system (BAS) for unified monitoring.
- C. Provide temporary power and network access during commissioning as needed.

3.03 TESTING AND COMMISSIONING

- A. Verify accuracy of all power meters and CTs per manufacturer procedures (target -1% or better).
- B. Demonstrate automatic data communication, proper aggregation into IECC end-use categories, 36- month data retention capability, and full graphical reporting functionality in the EMX portal.
- C. Simulate or show hourly/daily/monthly/yearly views for all required categories.
- D. Provide on-site training to Owner's operations personnel on accessing the EMX Energy Portal, generating reports, and basic troubleshooting.
- E. Prepare a commissioning report documenting compliance with IECC 2021 C405.12.

3.04 CLOSEOUT

- A. Deliver as-built drawings with final monitor/CT locations and wireless network diagram.
- B. Provide login credentials and administrator training for the EMX Energy Portal.
- C. Submit final calibration certificates and O&M manuals.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Hospital-grade receptacles.
 - 3. Isolated-ground receptacles.
 - 4. Tamper-proof receptacles.
 - 5. Weather-resistant receptacles.
 - 6. Twist-locking receptacles.
 - 7. Time switches.
 - 8. EPO switches.
 - 9. Pendant cord-connector devices.
 - 10. Cord and plug sets.
 - 11. Switches and wall-box dimmers.
 - 12. Solid-state fan speed controls.
 - 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
- B. Related Sections include the following:
 - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.
 - 2. Division 27 Section "Lighting Control Devices" for switchbox-mounted occupancy sensors.

1.2 DEFINITIONS

- A. EPO: Emergency power off.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge Protective Device.
- G. UTP: Unshielded twisted pair.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.4 ACTION SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For each type of product indicated under PART 2 – PRODUCTS.
- C. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- D. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - 1. Manufacturer's routine maintenance requirements for wiring devices and all installed components.
 - 2. Manufacturers' packing label warnings and instruction manuals.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
 - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
 - 4. Keys for Locking Switches and Covers: One for every 10 of each type installed, but no fewer than two of each type.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.
- B. Comply with NFPA 99
- C. Comply with NFPA 70

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles. Part numbers listed under products paragraphs in Part 2 articles of this section are included to list the manufacturers' product series and they do not designate the color of the device. Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).
3. Pass & Seymour/Legrand; (Pass & Seymour).

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. B. Comply with NFPA 70.

B. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT BLADE RECEPTACLES

A. Hospital-Grade, Convenience Receptacles, Decorative Style, 125 V, 20 A:

1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
 - b. Description: Hospital Grade receptacles constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece steel grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL2182 (duplex).
 - b. Leviton; 16362-HG (duplex).
 - c. Pass & Seymour; 26362-HG (duplex).
 - d. Modular option:
 - 1) Hubbell; SNAP2182 & SNAP2RNA.
 - 2) Leviton; M1636-HG & MSTWL-A (duplex).
 - 3) Pass & Seymour; PT26362HG & PTR6STR (duplex).

B. Industrial-Grade, Isolated-Ground, Convenience Receptacles, Decorative Style, 125 V, 20 A:

1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 Supplement SD.
 - b. Description: Industrial Specification Grade receptacles constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot; One-piece steel grounding strap; green ground

screw and automatic grounding system attached to the strap. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; DR20IG.
 - b. Leviton; 16362-IG.
 - c. Pass & Seymour; IG26362.
 - d. Modular Option:
 - 1) Hubbell; SNAPDR20IG & SNAP2RNA.
 - 2) Leviton; M1636-IG & MSTWL-A.
 - 3) Pass & Seymour; PTIG26362 & PTR6STR.

A. Hospital-Grade, Tamper-Resistant Convenience Receptacles, Decorative Style, 125 V, 20 A:

1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
 - b. Description: Hospital Grade receptacles constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wiper, T-slot; One-piece steel grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL8300SG (duplex).
 - b. Leviton; 16362-SG. (duplex).
 - c. Pass & Seymour; TR26362HG (duplex).
 - d. Modular option:
 - 1) Leviton; MT163-HGx & MSTWL-A (duplex).
 - 2) Pass & Seymour; PTTR26362HG & PTR6STR (duplex).

2.4 GFCI RECEPTACLES

A. Hospital-Grade, GFCI Convenience Receptacles, 125 V, 20 A:

1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6, UL 498 Supplement SD, UL 943, Class A, and Federal Specification (FS) W-C-596.
 - b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting 2006 CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.
 - 1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
 - 2) Device shall not allow current to pass through device when miswired.

- c. Description: Hospital Grade straight blade receptacle constructed of highimpact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece nickel-platted brass grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade. LED indicator on face.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFR8300HxLA.
 - b. Leviton; N7899-HG.
 - c. Pass & Seymour; 2095-HG.
 - d. Modular Option:
 - 1) Hubbell; GFR8300SNAPxNA & SNAP2RNA.
 - 2) Leviton; M7899-HG & MSTWL-A.
 - 3) Pass & Seymour; PT2095HG & PTR6STR.
- B. Hospital-Grade, Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD, UL 943, Class A, and Federal Specification (FS) W-C-596. Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
 - b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting 2006 CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.
 - 1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
 - 2) Device shall not allow current to pass through device when miswired.
 - c. Description: Hospital Grade straight blade receptacle constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece nickelplatted brass grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFR8033HTR.
 - b. Leviton; X7899-HG
 - c. Pass & Seymour; 2095-HGTR
 - d. Modular Option:
 - 1) Hubbell; GFTR8300SNAPxNA & SNAP2RNA.
 - 2) Leviton; MT7899-HG & MSTWL-A.
 - 3) Pass & Seymour; PT2095HGTR & PTR6STR.
- C. Industrial-Grade, Tamper-Resistant, Weather Resistant GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Requirements:

- a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 Supplement SD, UL 943, Class A, and Federal Specification (FS) W-C-596. Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
 - b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting 2006 CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.
 - 1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
 - 2) Device shall not allow current to pass through device when miswired.
 - c. Description: Industrial Specification Grade receptacle constructed of a high impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot; One-piece steel grounding strap; green ground screw and automatic grounding system attached to the strap.
2. Products: Subject to compliance with requirements, provide one of the following:
- a. Hubbell; GFR5362TR.
 - b. Leviton; WT899.
 - c. Modular Option:
 - 1) Hubbell; GFTR5362SNAPxNA & SNAP2RNA.
- D. Faceless GFCI Convenience Receptacles, 125 V, 20 A:
1. Requirements:
- a. Comply with NEMA WD 6, Class A, and UL 943.
 - b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting 2006 CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.
 - 1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
 - 2) Device shall not allow current to pass through device when miswired.
 - c. Description: Blank face self test GFCI constructed of high-impact resistant thermo-plastic. Wide-body design; back and side-wired; double wipe, brass contact design; One-piece zinc-plated steel grounding strap; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade. LED indicator on face.
2. Products: Subject to compliance with requirements, provide one of the following:
- a. Hubbell; GFSTBF20.
 - b. Leviton; X7590.
 - c. Pass & Seymour; 2085X.

2.5 USB RECEPTACLES

A. Hospital-Grade, USB, Tamper-Resistant Convenience Receptacles, Decorative Style 125 V, 20 A:

1. Requirements:
- a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 AND 1310.

- b. Description: Hospital Grade receptacle constructed of high-impact resistant thermoplastic with two USB 2.0 charging ports. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One piece steel grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.
- 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; USB8300.
 - b. Leviton; T5832.

2.6 SPECIAL CONFIGURATION & TWIST-LOCKING RECEPTACLES

- A. General: NEMA and Non-NEMA configurations as indicated on Drawings.
 - 1. Requirements: Comply with NEMA WD 1, NEMA WD 6; and UL 498.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell.
 - b. Leviton.
 - c. Pass & Seymour.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 - 2. Description:
 - a. Comply with NEMA WD 1, NEMA WD 6 Configuration as indicated on Drawings, and UL 498.
 - b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

- A. General: Matching, locking-type plug and receptacle body connector in NEMA and NonNEMA configurations as noted on drawings.
 - 1. Requirements:
 - a. Comply with NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and Federal Specification (FS) W-C-596.
 - b. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - c. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hubbell.
- b. Leviton.
- c. Pass & Seymour.

2.8 CORD AND PLUG SETS

- A. General: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Requirements:
 - a. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 - b. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell.
 - b. Leviton.
 - c. Pass & Seymour.

2.9 SWITCHES

- A. General Description: All products listed shall meet the following requirements:
 - 1. Comply with NEMA WD 1, UL 20; Rated UL-94, V2 or better. Manufacturer shall test all switches for proper operation prior to shipment, sample testing is not acceptable.
 - 2. Description: Constructed of high-impact arc-resistant thermoplastic; back and sidewired; heavy-gauge copper alloy one-piece arm and silver-cadmium oxide contacts with quiet-action mechanism; heavy-gauge zinc-plated steel-mounting strap with automatic grounding feature. Compatible with fluorescent, tungsten and resistive loads; with a motor load capacity of at least 80% of switch's current rating. Terminal screws shall be brass double-combination: Philips-head, slotted. Mounting screws shall be triple combination: Philips-head, slotted, Robertson.
- B. Toggle Switches, 120/277 V, 20 A:
 - 1. Requirements: Comply with Federal Specification (FS) W-S-896; Industrial Specification Grade toggle switch.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
 - b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - c. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).
 - d. Modular option:
 - 1) Hubbell; SNAP1221 & SNAPSP1NA (single pole), SNAP1223 & SNAPSP2NA (three-way).
 - 2) Leviton; M1221 and MSPSW (single pole).

- 3) Pass & Seymour; PT20AC1 & PTR6STR (single pole), PT20AC3 & PTR6STR (three-way).
- C. Decorative Rocker Switches, 120/277 V, 15 A:
1. Requirements: Commercial Specification Grade rocker switch.
 2. Products: Subject to compliance with requirements, provide products from one of the following manufacturers:
 - a. Hubbell; DS120 (single pole), DS320 (three-way), DS420 (four-way).
 - b. Leviton; 5621-2 (single pole), 5623-2 (three-way), 5624-2 (four-way).
 - c. Pass & Seymour; 2621 (single pole), 2622 (two pole), 2623 (three-way), 2624 (four-way).
 - d. Modular option:
 - 1) Hubbell; SNAP2121 & SNAPSP1NA (single pole), SNAP2123 & SNAPSP2NA (three-way).
 - 2) Pass & Seymour; PT2621 & PTS6STR3 (single pole), PT2623 & PTS6STR4 (three-way).
- D. Pilot Light Switches, 120/277 V, and Federal Specification (FS) W-C-596, 20 A:
1. Requirements: Industrial Specification Grade toggle switch; Single pole, with LED or NEON-lighted handle, illuminated when switch is "ON."
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221PL (single pole), HBL1223PL (3-way) for 120/277V.
 - b. Leviton; 1221-PLC (single pole), 1223-PLC (3-way) for 120 V; 1221-7PLC (single pole), 1223-7PR (3-way) for 277 V.
 - c. Pass & Seymour; PS20AC1-RPL (single pole), PS20AC3-RPL (3-way) for 120 V; PS20AC1-RPL7 (single pole), PS20AC3-RPL7 (3-way) for 277 V.
 - d. Modular option:
 - 1) Hubbell; SNAP1221PL & SNAPSP1NA (single pole), SNAP1223PL & SNAPSP2NA (three-way).
- E. Illuminated Light Switches, 120/277 V, 20 A:
1. Requirements: Industrial Specification Grade toggle switch; Single pole, with LED or NEON-lighted handle, illuminated when switch is "OFF."
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221IL (single pole); HBL1223IL (3-way) for 120/277V.
 - b. Leviton; 1221-LHC (single pole), 1223-LHC (3-way) for 120 V; 1221-7LC (single pole) 1223-7LC (3-way) for 277 V.
 - c. Pass & Seymour; PS20AC1-CSL (single pole); PS20AC3-CSL (3-way) for 120/277V.
 - d. Modular option:
 - 1) Hubbell; SNAP1221IL & SNAPSP1NA (single pole), SNAP1223IL & SNAPSP2NA (three-way).
 - 2) Leviton; M1221-LHC (single pole), M1223-LHC (3-way) for 120 V.
 - 3) Pass & Seymour; PT20AC1-CSL & PTS6STR3 (single pole), PT20AC3CSL & PTS6STR4 (three-way) for 120 V, PT20AC1-CSL & PTS6STR3277 (single pole), PT20AC3CSL & PTS6STR4277 (threeway) for 277 V.
- F. Key-Operated / Security Switches, 120/277 V, 20 A:

1. Requirements: Single pole, with factory-supplied key in lieu of switch handle. Corbin-style or Barrel lock and key, single-hump key not acceptable.
 2. Description: Single pole, with factory-supplied key in lieu of switch handle.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221RKL.
 - b. Leviton; 1221-2KL.
 - c. Pass & Seymour; PS20AC1-KL.
- G. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1557.
 - b. Leviton; 1257.
 - c. Pass & Seymour; 1251.
- H. Decorative Rocker Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 15 A:
1. Requirements: Commercial Specification Grade rocker switch.
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton; 5657-2.
 - b. Pass & Seymour; 2601.
- I. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 24 V.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton; 1081.
 - b. Pass & Seymour; 1081.
- J. Decorative Rocker Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 24 V:
1. Requirements: Commercial Specification Grade rocker switch.
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; DSM30x2.
 - b. Leviton; 56081-2.
- K. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A;
1. Requirements: with factory-supplied key in lieu of switch handle. Corbin-style or Barrel lock and key, single-hump key not acceptable.
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1557L.
 - b. Leviton; 1257L.
 - c. Pass & Seymour; 1251L.

2.10 WALL-BOX DIMMERS

A. General Description: All products listed shall meet the following requirements:

1. Dimmer Switches: Modular, full-wave, solid-state unit with integral, quiet on-off switch complying with UL 20; audible frequency and EMI/RFI suppression filters.
2. Comply with ANSI/IEEE standard C62.41-1997 for surge withstand.
3. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
4. Memory: Power-failure memory to maintain previously set lighting level upon return of power after outage without human intervention.

B. LED Lamp Dimmer Switches, 120/277 V:

1. Requirements: Control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module. Modular; compatible with drivers as specified under Division 26 Section "Interior Lighting"; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness. Dimmers shall require no derating when ganged with other devices; provide narrow-fin and wide-fin designs as required.
2. Products: Subject to compliance with requirements, provide products from one of the following manufacturers:
 - a. Leviton.
 - b. Greengate
 - c. Lutron.

2.11 DIGITAL TIME WALL SWITCH

- A. Requirements: Adjustable time delay up to 2 hours, LCD digital display, Audible or 'Blink' Warning.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Hubbell Building Automation; TD200.
 2. Hubbell; DT1277.
 3. Leviton; LTBxx.
 4. Watt Stopper; TS-400.

2.12 EPO SWITCHES

- A. General Description: All products listed shall meet the following requirements:
 1. Operators shall be heavy duty type and comply with UL Type 13/NEMA Type 13 and UL Type 6/NEMA Type 6.
 2. Contact blocks shall be rated 10 amperes continuous.
- B. Available Products: Subject to compliance with requirements, provide the following as indicated on the Drawings:
 1. Mushroom type: Flush mounted, two position, maintained push - maintained pull mushroom head type push button operator with 2.25 inch diameter mushroom top, red, with one normally open and one normally closed (1NO - 1NC) contact. Provide with aluminum extended mushroom guard.

2. Push button type: Flush mounted, two position, momentary push button, red insert, with one normally open and one normally closed (1NO - 1NC) contact. Provide with a hinged, lockable protective cover guard.
3. Key operated type: Flush mounted, two position, key operated push button, with one normally open and one normally closed (1NO - 1NC) contact. The operator shall be set by rotating the key, with the button in the extended position. The key is removable only in this set position. When pushed, the button will then lock into position. The key must be inserted and rotated to reset to the extended position. Provide with a hinged, lockable protective cover guard.
4. Break glass type: Flush mounted, two position "break glass" operator. Operator shall be held in a depressed position by a glass disc. When the glass disc is broken by the chain-attached hammer, the button shall return to a normal extended position. Provide a package of five discs with the operator. Provide operator and contact block with one normally open and one normally closed (1NO - 1NC) contact.

2.14 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Requirements:
 - a. Plate-Securing Screws:
 - 1) Metal with head color to match plate finish.
 - 2) Tamper-resistant metal screws with head color to match plate finish for Secure and Disturbed Patient Holding and similar rooms.
 - b. Material for Finished Areas: Stainless Steel
 - c. Material for Utility Areas: Stainless Steel.
 - d. Material for Unfinished Areas: Stainless Steel.
 - e. Material for Damp Locations: Thermoplastic (nylon) with spring-loaded lift cover, and listed and labeled for while in use in "wet locations."
2. Products: Subject to compliance with requirements, provide plate from same manufacturer as device.

B. Wet-Location, Weatherproof Cover Plates:

1. Requirements: NEMA 250, complying with type 3R weather-resistant while-in-use metal with lockable cover; non-removable gasket between the mounting plate/base and cover; stainless steel hinges and mounting hardware
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton;
 - 1) Horizontal Mount: M5999-GY.
 - 2) Vertical Mount: M5979-GY.
 - b. Pass & Seymour; Horizontal or Vertical Mount: WIUCAST1.
 - c. TayMac Corporation; a Division of Hubbell Incorporated;
 - 1) Horizontal Mount: WP826H. 2) Vertical Mount: WP826.

2.15 FLOOR SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell.
 - 2. Thomas & Betts Corporation.
 - 3. Wiremold Company (The).
- B. Requirements:
 - 1. Type: Modular, flush-type, dual-service units suitable for wiring method used.
 - 2. Compartments: Barrier separates power from voice and data communication cabling.
 - 3. Service Plate: Rectangular, die-cast aluminum with satin finish, powder painted or electro-plated finish.
 - 4. Power Receptacle: Devices as indicated on Drawings, meeting the requirements for receptacles listed in this section above, unless otherwise indicated.
 - 5. Voice and Data Communication Outlet: Blank cover with bushed cable opening, Devices as indicated on Drawings.

2.16 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Pass & Seymour/Legrand.
 - 3. Square D/Schneider Electric.
 - 4. Thomas & Betts Corporation.
 - 5. Wiremold Company (The).
- B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly. Comply with UL 514 scrub water exclusion requirements.
 - 1. Service Outlet Assembly: Devices as Indicated on Drawings.
 - 2. Size: Selected to fit nominal 4-inch (100-mm) cored holes in floor and matched to floor thickness.
 - 3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 - 4. Closure Plug: Arranged to close unused 4-inch (100-mm) cored openings and reestablish fire rating of floor.
 - 5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

2.17 PREFABRICATED MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold Company (The).
- B. Description:

1. Two-piece surface metal raceway, with factory-wired multioutlet harness.

2. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Aluminum.

D. Multioutlet Harness:

1. Receptacles: Meeting the requirements for receptacles listed in this section above, unless otherwise indicated.
2. Receptacle Spacing: As indicated on Drawings.
3. Wiring: No. 12 AWG solid, Type THHN copper; single or dual circuit as indicated.

E. Finish: As selected by Architect

F. Power Receptacle: Devices as indicated on Drawings, meeting the requirements for receptacles listed in this section above, unless otherwise indicated.

G. Voice and Data Communication Outlet: Blank cover with bushed cable opening Devices as Indicated on Drawings.

2.18 SERVICE POLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).

B. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

1. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
3. Finishes: Manufacturer's standard painted finish and trim combination.
4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
5. Power Receptacles: [NEMA WD 6 configuration 5-20R], [Devices as indicated on Drawings], meeting the requirements for receptacles listed in this section above, unless otherwise indicated.
6. Voice and Data Communication Outlets: Blank cover with bushed cable opening Devices as Indicated on Drawings.

2.19 FINISHES

A. Color: Wiring device catalog numbers in Section Text above do not designate device color. The wiring devices and associated wall plates shall conform to the colors listed in Table 1 below or as otherwise required by NFPA 70. **Final color selections for all devices and wall plates shall be submitted to and approved by the Architect.**

1. * Indicates: Provide Orange Triangle on device to Indicate Isolated Ground Receptacle
2. ** Indicates: Engrave (Metal) or Hot Stamp (Thermoplastic) as indicated in "Identification" paragraphs of PART 3 - Execution section.

Table 1

<u>Connected to Normal Power in Finish Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Light Almond	Metal	Black
GFCI NEMA 5-20R Receptacles	Light Almond	Metal	Black
Isolated Ground NEMA 5-20R Receptacles	Light Almond *	Metal	Black
Tamper Resistant NEMA 5-20R Receptacles	Light Almond	Metal	Black
SPD NEMA 5-20R Receptacles	Blue	Metal	Black
IG-SPD NEMA 5-20R Receptacles	Blue*	Metal	Black
Switches & Wall Box Dimmers	Light Almond	Metal	Black
Switchbox-Mounted Occupancy Sensors	Light Almond	Metal	Black
<u>Connected to Normal Power in Utility Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Light Almond	Metal	Black
GFCI NEMA 5-20R Receptacles	Light Almond	Metal	Black
Switches	Light Almond	Metal	Black
Switchbox-Mounted Occupancy Sensors	Light Almond	Metal	Black

<u>Connected to Emerg. Pwr. in Finish Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Red	Metal	Red
GFCI NEMA 5-20R Receptacles	Red	Metal	Red
Isolated Ground NEMA 5-20R Receptacles	Red*	Metal	Red
Tamper Resistant NEMA 5-20R Receptacles	Red	Metal	Red
SPD NEMA 5-20R Receptacles	Blue	Metal	Red
IG-SPD NEMA 5-20R Receptacles	Blue*	Metal	Red
Switches & Wall Box Dimmers	Red	Metal	Red
Switchbox-Mounted Occupancy Sensors	Red	Metal	Red

<u>Connected to Emerg. Pwr. in Utility Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Red	Metal	Red
GFCI NEMA 5-20R Receptacles	Red	Metal	Red
Switches	Red	Metal	Red
Switchbox-Mounted Occupancy Sensors	Light Almond	Metal	Red

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following for all indoor applications, unless otherwise indicated:
 1. Receptacle Grade: Hospital-Grade
 2. Receptacle Style: Decorative (Rectangular Face) (Confirm with architect)
 3. Switch Style: Decorative Rocker
- B. Receptacles in Patient Care Areas: Install Hospital Grade devices where device is located within a Patient Care Area as defined by NFPA 70 Article 517 or the Authorities Having Jurisdiction.
- C. GFCI Receptacles: Install in locations as indicated but in no case less than those listed below:
 1. Where device is located on the exterior of the building, provide with Wet-Location Weatherproof Cover Plate.
 2. Where device is located within kitchen.
 3. Where device is located in an elevator pit.
 4. Where device is located within 6 feet (2-m) of a lavatory or sink, except where located on patient headwall.
- D. Tamper-Resistant Receptacles: Install in locations as indicated but in no case less than those listed below:
 1. **All** Public spaces. Including but not limited to:
 - a. Corridors
 - b. Public Lobbies.
 - c. Waiting Rooms.
 - d. Secure and Behavioral Patient Holding and similar rooms.

3.2 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise indicated.
- B. Mounting Heights: Comply with applicable codes and requirements of Authorities Having Jurisdiction. Mount devices as indicated on Drawings, including but not limited to Architectural elevations. Coordinate all above counter receptacles with backsplash to avoid interferences. All dimensions are given to centerline of box above finished floor (AFF), unless otherwise indicated.

- C. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
 - 5. Install wiring devices with appropriate backbox and raceway according to room finish (i.e. flush mounted devices in recessed backboxes with concealed conduit in finished spaces; surface mounted boxes with exposed conduit in unfinished spaces. Refer to architectural documents for room finish types.
- E. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- F. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until substantial completion.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
 - 10. Mount Switches or Wall Box Dimmers within 6 inches (152 mm) of door frame, unless otherwise indicated.

11. Install Isolated-Ground devices so as not to bond the ground pole or isolated ground conductor (green/yellow) to the conduit system or equipment ground conductor (green).
 12. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical.
- G. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the left (i.e. neutral blade at the top).
- H. Device Plates and Covers:
1. Do not use oversized or extra-deep plates.
 2. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
 3. Install weather-proof-while-in-use covers over receptacles in wet, damp and exterior locations.
 4. Group adjacent devices under single, multigang wall plates.
- I. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- J. Floor Service Outlets, Service Poles and Poke-Thru Device
1. Adjust locations of floor service outlets, service poles, and Poke-Thru devices to suit arrangement of partitions and furnishings. Coordinate revised location with Structural Engineer.
 2. Install Poke-Thru devices within their listing. Install devices so there is no more than 1 device per 64-square-feet (5.95-Square-meters) of floor area and so there is no less than 2-feet (.61-m) separation between adjacent devices.

3.3 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served on all receptacles. Use Engraved machine printing for Metal and Hot Stamped for Thermoplastic wall plates. All lettering shall be filled on face of plate, lettering color as indicated in the table in Part 2 above.
2. Switches: Identify panelboard and circuit number from which served on All switches. Use engraved machine printing for metal and hot stamped for thermoplastic wall plates. All lettering shall be filled on face of plate, lettering color as indicated in the table in Part 2 above.

3.4 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. For EPO switches, provide 120V power where control power is not provided from equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems.
 - 2. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 105 to 132 V.
 - b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - c. Ground Impedance: Values of up to 2 ohms are acceptable.
 - d. Polarity: test for correct neutral conductor to neutral terminal connection.
 - e. Using the test plug, verify that the device and its outlet box are securely mounted.
 - f. GFCI Receptacles: Test for tripping values specified in UL 1436 and UL 943.
 - 3. Tests for patient-care areas in Healthcare Facilities: In addition to the test listed above, perform additional field tests and inspections for receptacles in patient care areas. Perform the following tests:
 - a. Test straight blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).
 - b. Test and record the resistance between the ground point of each receptacle and the reference point according to NFPA 99. Resistance level shall be less than 0.1 Ohm.
 - 4. Prepare certified test reports in compliance with NFPA 99 and submit reports in conjunction with field quality control reports required in Division 26 Section "Grounding and Bonding for Electrical Systems". Utilize the Patient Care Area Electrical Testing Form in the Appendix of Division 26 Section "Grounding and Bonding for Electrical Systems" for each patient care area.
 - 5. Test Instruments:
 - a. Use instruments that comply with UL 1436.
 - b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Correct Deficiencies and Report:
 - 1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace devices as required to bring system into compliance.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Prepare a report, certified by testing agency, that identifies enclosure, units, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

C. Wiring device will be considered defective if it does not pass tests and inspections.

3.6 CLEANING

A. Clean components according to manufacturer's written instructions.

B. On completion of device box installation but before any wiring devices are installed, inspect interior of boxes and perform the following:

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

C. On completion of wall plate installation, inspect exterior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Remove all temporary markings and labels.
3. Replace cracked or damaged wall plates.
4. Wipe down all wall plates with approved cleaning agent to remove fingerprints and dust.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of circuit and motor disconnect switch work is indicated on drawings.

1.02 QUALITY ASSURANCE

- A. Comply with National Electrical Code requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
- B. Comply with requirements of UL 98, "Enclosed and Dead-Front Switches". Provide circuit and motor disconnect switches that are UL listed and labeled.

PART 2 - PRODUCTS

2.01 FABRICATED SWITCHES

- A. Disconnect Switches: Provide heavy-duty surface mounted, sheet-steel enclosed switches, of types, sizes and with fusing and other electrical characteristics indicated or required. Switches shall be rated 240 volts for use on 240/120 volt systems and 600 volts for use on 480Y/277 volt systems, 60 Hz, with blades, and poles as required for their application. Units shall incorporate spring assisted, quick-make, quick-break switches, which are constructed so that switch blades are visible in OFF position with door open. Equip each unit with an operating handle that is an integral part of enclosure base, whose operating position is easily recognizable, and which is capable of being padlocked in OFF position. Construct current carrying parts of high-conductivity plated copper. Unless noted otherwise, provide NEMA Type 1 enclosures for interior use and NEMA Type 3R enclosures for exterior use. Switches shall be Square D Class 3110, Cutler Hammer Type DH, Siemens VBII, General Electric Type TH, or approved equal.

2.02 FUSES FOR FUSIBLE SWITCHES

- A. Fuses for circuits 601 amps and larger shall be UL listed Class L with time delay feature, with an interrupting rating of 300,000 amperes.
- B. Fuses for circuits 600 amps and less shall be UL Listed Class R time delay fuses with an interrupting rating of 300,000 amperes. Class R fuses shall be true dual element, time delay fuses, full sized with end caps that can be tested to determine if the fuse is blown. Fuses shall be indicating type where noted below.
- C. Fuses for safety switches protecting panelboards shall be UL listed Type Class RK-1, indicating type, with time delay feature.

- D. Fuses for 480-volt motor circuits shall be 600 volt, Class RK1, indicating type.
- E. All other fuses shall be dual element time delay type UL listed Type Class RK-5.
- F. Fuses for switches used as disconnecting means for motors and other equipment shall be sized in accordance with the nameplate requirements of the equipment actually installed.

2.03 ENCLOSED CIRCUIT BREAKERS

- A. Circuit Breakers: Provide surface mounted, sheet-steel enclosed circuit breakers, of types, sizes and with other electrical characteristics indicated or required. Breakers shall be rated 240 volts for use on 208/120 volt systems and 600 volts for use on 480Y/277 volt systems, 60 Hz, with poles as required for their application. Provide shunt trip devices where shown. Unless noted otherwise, provide NEMA Type 1 enclosures for interior use and NEMA Type 3R enclosures for exterior use. Breakers shall be Square D, Cutler Hammer, Siemens, or approved equal.
- B. Imaging Equipment: Where circuit breakers serve Imaging Equipment, electrical contractor shall coordinate all requirements with most up to date, site specific Imaging Equipment drawings. Coordinate all requirements with manufacturer and provide all equipment, components, and accessories as required.

PART 3 - EXECUTION

3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. Install circuit and motor disconnect switches in compliance with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and recognized industry practices.
- B. Install disconnect switches for use with motor-driven appliances, and motors and controllers within sight of controller position.
- C. Provide etched laminated label on each disconnect switch. Label shall identify equipment served by the switch.

3.02 GROUNDING

- A. Provide equipment-grounding lugs in all switches with connections, sufficiently tight to assure a permanent and effective ground.

3.03 FIELD QUALITY CONTROL

- A. Subsequent to completion of installation of electrical disconnect switches or circuit breakers, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 26 32 13
ENGINE-DRIVEN GENERATOR SETS - DIESEL

PART 1 - GENERAL

1.1 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this section.
- B. Related Sections:
Section 26 36 00 – Automatic Transfer Switches

1.2 REFERENCE STANDARDS

- A. NFPA 101 - Life Safety Code
- B. NFPA 110 – Emergency and Standby Power Systems
- C. ANSI/NEMA MG 1 - Motors and Generators
- D. UL2200 – Stationary Engine Generator Assemblies

1.2 PERMITS

- A. The Contractor shall be responsible for obtaining all necessary permits for the complete installation of the generator fuel system and related equipment.

1.3 SUBMITTALS

- A. Submit shop drawings showing detailed equipment assemblies and indicate dimensions, weights, loads, required clearances, plan and elevation views with overall location and interconnection point dimensions, method of field assembly, components and location and size of each field connection.
- B. Include product data for generator and all accessories: batteries and charger, engine generator set, muffler, exhaust piping external to unit, outdoor enclosure, remote annunciator(s), remote emergency stop, load center and lighting integral to enclosure, cooling system heaters. In addition, fuel consumption rate curves at various loads, ventilation and combustion air requirements, thermal damage curves for generator, time current characteristic curves for generator protective device (if included) and electrical ratings and diagrams including schematic and interconnection diagrams.
- C. Certified Test Reports. Factory test reports including noise level, exhaust emissions, and field quality tests.
- D. Certification of Torsional Vibration Compatibility.
- E. Documentation for a 1 year comprehensive engine, parts, and enclosure warranty.
- F. Wiring diagram for status of generator output circuit breaker(s) or OCPD serving the emergency side of each automatic transfer switch. Include annunciation and indication monitoring integral to annunciator panel. Submit manufacturer's installation instructions.
- E. Provide verification of coordination for Emergency and Legally Required Standby systems overcurrent devices with all supply side overcurrent protective devices.

1.4 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in packaged engine generator systems with minimum ten years documented experience. Packaged generator assembly shall meet UL 2200 requirements.
- B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 100 miles of project site.

1.6 EXTRA MATERIAL

- A. Provide two additional sets of each fuel, oil, and air filter elements required for the engine generator system and one additional set of all required belts.

PART 2-PRODUCTS

2.1 SYSTEM RATINGS

- A. Generator Set Rating: See Drawings for KW Rating, 0.8pf, 480/277 VAC, 3 phase, 4 wire, 60 Hz. Standby power rated.
- B. The generator set manufacturer shall verify the engine as capable of driving the generator with all accessories in place and operating at the nameplate rating after de-rating for the range of temperature expected in service and the altitude of the installation.
- C. The engine-generator set shall be capable of picking up 100% of nameplate kW, less applicable de-rating factors, in one step with the engine-generator set at operating temperature.
- D. Voltage regulation shall be $\pm 1.0\%$ of rated voltage for any constant load between no load and rated load. Random voltage variation with any steady state load from no load to full load shall not exceed $\pm 1.0\%$ of rated voltage.
- E. Frequency regulation shall be $\pm 0.5\%$ from steady state no load to steady state rated load.
- F. Harmonic distortion shall not exceed 5% total harmonic distortion at full linear load and no single harmonic shall exceed 3% of rated voltage.
- G. Manufacturer shall be Cummins.

2.2 ENGINE AND ENGINE EQUIPMENT

- A. Engine Type: Water-cooled, normally aspirated, four cycle, internal combustion engine.
- B. Fuel Type: Diesel
- C. Governor: Isochronous electronic type to maintain engine speed within 0.5 percent, steady state, and 1 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.
- D. Safety Devices: Engine shutdown on high water temperature, low oil pressure, over-speed, and engine over-crank. Limits as selected by manufacturer.
- E. Engine Accessories: Include intake air filter, fuel filter, fuel priming pump, automatic electric fuel shutoff, fuel/water separator, gear-driven water pump, positive displacement mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements, dipstick oil level indicator, and oil drain valve with hose extension. Include engine mounted battery charging alternator with solid state voltage regulator.
- F. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C).
- G. The consultant shall determine the type of cooling system required for the application and edit the following paragraph accordingly.
- H. Cooling System: Unit mounted radiator using glycol coolant, with blower type fan, coolant pump and thermostat temperature control sized to maintain safe engine temperature in ambient temperature of 105 degrees F. Radiator shall be provided all ductwork required with a duct adapter flange permitting the attachment of air discharge duct directing the discharge of radiator air to exterior louver location.. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.
- I. Exhaust System: Provide critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine

manufacturer's instructions. The muffler shall be mounted so its weight is not supported by the engine.

- J. Flexible exhaust connections shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.
- K. Provide an exhaust condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from entering the engine. Provide drain line to drip pan.
- L. Provide a suitable rain cap at the stack outlet. Provide all necessary flanges and special fittings for proper installation.
- M. Fuel System: Provide fuel lockout solenoid and fuel regulator, based on manufacturers operating pressure, between 7"-14" H₂O.
- N. Provide flexible supply and return line fittings and all connections for connecting fuel system to the engine in compliance with applicable codes and regulations. All fuel piping shall be pressure tested for minimum 2 hours. Primary regulator and flexible fuel hose with stainless steel over-braid shall be provided by the generator supplier.
- O. Coordinate with local utility gas provider for new gas service and associated regulator. Piping shall be compliant with utility company installation requirements and NFPA 110. Provide a gas meter and regulator for the generator service. Meter and regulator serving generator shall be separate from the building's gas service and shall be connected on the supply side of the main gas shutoff valve to allow for emergency response team to shut off building gas service without shutting of generator gas service
- P. Provide separate identifying labeling and tags at shutoff valves indicating an emergency generator and main building per NFPA 110.
- Q. Batteries: Heavy duty, lead-acid storage batteries. Provide a DC 12 volt system with number of batteries and battery capacity as sized by the manufacturer adequate for (4) 30 second cranking periods (total of 2 minutes) along with all additional loads being run on the DC system. Battery submittals shall include type, amp-hour rating and cold cranking amps.
- R. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

2.3 ALTERNATOR

- A. Insulation: ANSI/NEMA MG 1, Class H.
- B. Alternator Speed: 1,800 rpm
- C. The unit shall be single bearing, self-aligning 4-pole, brushless, synchronous type, revolving field windings, and direct driven centrifugal blower for proper cooling and minimum noise. No brushes will be allowed.
- D. The unit shall be 3-phase, broad-range, re-connectable and shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit. Leads shall terminate in NEMA 1 connection enclosure. A fully rated, isolated neutral connection shall be included by manufacturer.
- E. The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H".
- F. The regulator design shall include torque-matching characteristics to allow the engine to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to optimize motor starting capability and provide the fastest possible recovery from transient speed dips. Regulators which use a fixed volt per hertz characteristic are not acceptable.
- G. The alternator shall include a permanent magnet generator (PMG) exciter and electronic voltage regulator, and shall be self-ventilated drip-proof construction built in accordance with NEMA, AIEE and ANSI standards.
- H. The alternator shall be protected against overloads and short circuits by electronic control panel protective functions. Functions shall be implemented electronically in the control panel. The generator

design shall be of the self-protecting type as demonstrated by the prototype short circuit test. Systems utilizing 3-wire, solid state control elements rotating in the rotor, will not be acceptable.

2.4 OVER CURRENT PROTECTIVE DEVICE

- A. Two 3 pole, 100% electronic, circuit breaker, on generator output with adjustable long time and short time delay and instantaneous trip; complying with NEMA AB 1 and UL489. Trip settings shall be factory set to generator thermal damage curve. See drawings for amperages
- B. Include battery-voltage operated shunt trip, connection to open circuit breaker(s) when generator is shut down by internal or external protective devices.

2.5 ACCESSORIES

- A. Provide the following accessories with the engine generator set.

Enclosure: Level 1 Sound and Weather protective housing with the following features:

Vandal-resistant

Galvanized steel body

Lifting points on base frame

Stainless steel flush fitting latches and hinges

Stainless steel fasteners

Sheet steel components pre-treated with zinc phosphate prior to polyester powder coating

Multiple lockable panels/doors on each side installed to allow access to components requiring maintenance

Radiator fill access door with lockable cover

Engine cooling via airflow through enclosure

Lube oil and coolant drains piped to the exterior of the enclosure skid base

Battery can only be reached through lockable doors

Air discharge to be horizontal from radiator

- B. Electrical Devices - Enclosure: GFCI WP receptacle. Devices and associated circuitry shall be field installed by the Electrical Contractor. Connect to Panel A utilizing 2#10, 1#10G, 1"C.
- C. Battery Tray: Plastic coated metal tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.
- D. Battery Charger: A 10-ampere voltage regulated battery charger shall be provided for the engine-generator set. Charger shall be equipped with float, taper and equalize charge settings. Charger shall include overload protection, voltage surge suppressor, DC voltmeter and fused AC input. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of:
 - Loss of AC power - red light (no relay contact)
 - Low battery voltage - red light
 - High battery voltage - red light (no relay contact)
 - Charger fail - red light
- E. Engine-Generator Digital Control Panel - Unit mounted: Provide a control panel with the top not more than six (6) feet above finished floor (this may require remote mounting). NFPA – 110, NEMA Type 1 generator mounted control panel enclosure with engine and generator controls and indicators containing the following:

Automatic remote start capability

"Run-Off-Auto" switch

Shut downs as required by NFPA 110 5.6.5.2(3)

Alarms as required by NFPA 110 5.6.5.2(4)

Individual alarm indication as required by NFPA 110.5.6.5.2(4) and table 5.6.5.2

Controls as required by NFPA 110 5.6.5.2(5)

Include remote starting control circuit, with RUN-OFF-AUTO selector switch on engine generator control panel.

Fuel pressure, water temperature, and lube oil pressure shall be monitored by the engine-generator controller.

The control shall include surge suppression for protection of solid state components. A front control panel illumination lamp with On/Off switch shall be provided. The engine-generator set starting batteries shall power the monitor.

- F. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
- G. Remote Alarm Contacts: Pre-wire form C contacts to terminal strip for remote alarm functions required by ANSI/NFPA 110.
- H. Remote Mounted Annunciator Panel: Flush Mounted. Digital. Annunciator panel shall be powered from unit storage battery and located at a location accessible and monitored by staff. Coordinate with owner for location. A remote, audible alarm shall be provided per NFPA 110-5.6.5.2(4).

The annunciator shall have provisions for spare relay based inputs for audible/ visual alarms to meet the requirements of these specifications. Refer to Generator Source Alarm Annunciation/ Indication.

The annunciation alarm shall be capable of being silenced and the panel shall include repetitive alarm circuitry so that after the audible alarm has been silenced, it re-activates after the fault condition has been cleared.

Provide all wiring and raceway systems as required.

- I. Remote Emergency Stop "Mushroom" Switch: Provide emergency shut off switch on the unit generator and one remote mounted device at location indicated on drawings.

Remote mounted devices installed outdoors shall be installed in approved wet location wiring method.

Provide label with "Emergency Shut Down"- White letters on Red background.

Provide all wiring, raceways and mounting systems as required.

- J. Generator Source Alarm Annunciation/Indication: Provide audio/visual alarm indication to generator control panel and to remote annunciator panel if the generator output circuit breaker(s) and OCPD serving the emergency side of each automatic transfer switch is in the "Tripped or "Open" position. Provide monitoring micro-switches. Provide wiring diagram at equipment submittal. Green light to indicate OCPD is closed and Red light to indicate OCPD is open. One point per each OCPD. Provide all wiring, raceway and contacts as required for this function. Separation between NEC article 700, 701 and 702 wiring shall be maintained.
- K. Provide wiring diagram at equipment submittal.
- L. Generator Feeder: The ampacity of the conductors from the generator terminals to the first distribution device containing overcurrent protection shall not be less than 115% of the nameplate current rating of the generator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that required utilities are available in proper location and ready for use.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Generator set shall be anchored to concrete pad.
- C. Coordinate with local utility gas provider for new gas service and associated regulator. Piping shall be compliant with utility company installation requirements. Shut off valve handle shall be removed and located inside generator enclosure if valve is installed exposed at generator.
- D. Control Conductors:

All generator control conductors installed between transfer equipment and the emergency generator serving Emergency, Legally Required Standby and Optional Standby systems shall be kept entirely independent of each other and all other wiring. This shall require a dedicated conduit system between each transfer switch and the emergency generator.

E. Grounding:

The generator shall be installed and connected as an equipment connection (not a separately derived system) and the factory installed generator ground/neutral bonding strap shall be removed.

F. Labeling:

Provide a sign at service entrance equipment indicating type and location of generator.

3.3 FIELD QUALITY CONTROL

- A. Operational testing of complete emergency electrical system shall be conducted prior to scheduling the required full load test to ensure complete system operation.
- B. Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.
- C. After the generator has cooled down from the four hour test, shut it down and simulate a power failure including operation of the transfer switch, automatic start up, shutdown and return to normal.

3.4 AGENCY TRAINING

- A. All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01, or 01 91 02.

END OF SECTION 26 3213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.

1.2 REFERENCES

- A. NEMA: National Electrical Manufacturers Association
- B. NETA: International Electrical Testing Association
- C. UL: Underwriters Laboratories
 - 1. UL 508: Industrial Control Equipment

1.3 SUBMITTALS

- A. Product Data: Submit for each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- C. Closeout Submittals: Provide operation and maintenance data.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

- A. General:
 - 1. The transfer switch, complete with all timers, relays, and accessories, shall be UL-listed under Standard UL-1008 and approved for use on emergency systems. The UL listing shall include the specific amperage ratings that are called for on the drawings.
 - 2. Contain a short circuit withstand capability and closing ratings when coordinated with circuit breakers in excess of the UL minimum requirement of 42,000 RMS amperes symmetrical.
 - 3. Completely wired, assembled, and tested by the manufacturer at the factory to ensure compatibility and to completely test the assembly.
 - 4. Provide the transfer switches as shown on the drawings with full load current rating of as specified at 480/277V, 3-phase, 4-wire, 60 Hertz AC normal and emergency.
 - 5. Capable of switching all classes of load and rated for continuous duty when installed in non-ventilated enclosures.

6. Provide exercise timer, automatically actuated, to permit weekly programming of engine generator test runs under load. If the emergency source should fail during the exercise period, and if normal power is available, the switch shall immediately restore to normal.
7. Auxiliary contacts shall be provided to monitor the status of the ATS.
8. Microprocessor controlled with front accessible HMI interface.
9. Listed and rated as service equipment.

B. Transfer Switch Construction:

1. Inherent 3-pole switch.
2. Double-throw actuated by two electrical operators momentarily energized and connected to the transfer mechanism by a simple over-center type linkage with a minimum transfer time of 400 MSEC. Provide an adjustable pneumatic timer, 0 to 60 seconds, on delayed equipment transfer switch.
3. Capable of transferring successfully in either direction with 70 percent of rated voltage applied to the switch terminals.
4. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in position in both the normal and emergency positions without the use of hooks, latches, magnets, or springs and shall be silver tungsten alloy protected by arcing contacts with magnetic blowouts on each pole.
5. Equipped with safe manual operators that are designed to prevent injury to the operating personnel if the electrical operation should suddenly become energized during manual transfer. The manual operator shall provide the same contact transfer speed as the electrical operator in order to prevent a flashover caused by switching the main contacts too slowly.
6. Include pilot lights on the enclosure door to indicate the switch closed on normal or emergency, and four auxiliary contacts on the main shaft, two closed on normal, and two closed on emergency. Load test switch to simulate normal power failure. All relays, timers, control wiring, and accessories shall be front accessible.
7. Voltage Sensing: Provide the automatic transfer switch with voltage sensing relays for each phase. Connection of these sensing relays shall be made to the normal power input terminals of the transfer switch. Voltage range shall be field adjustable.

C. Include a two position selector switch to select either automatic or manual transfer operation with pushbuttons to transfer to emergency and re-transfer to normal.

D. Install each automatic transfer switch in an enclosure with locking hinged door conforming to NEMA ICS and complying with the requirements of UL 508.

E. Main terminals requiring field wiring connections shall be suitable for copper or aluminum wiring.

F. Automatic transfer switches shall be suitable for satisfactory performance when installed for operation at 200-feet altitude, 40°C high and minus 20°C low ambient temperature, 90 percent relative humidity.

G. Color of the finish coat of paint shall be manufacturer's standard.

H. Acceptable manufacturer is Cummins X Series.

2.2 UNASSIGNED AUXILIARY CONTACTS

A. One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Neatly lace and secure the conductors of the feeder circuits individually at maximum 2 foot intervals. The cable lugs shall not support the weight of the cables.
- B. Automatic Transfer Switch: Install automatic transfer switch as shown on the drawings and according to the manufacturer's recommendations.

3.2 STARTUP, TESTING, AND TRAINING

- A. Comply with NETA standards.
- B. Perform startup and testing of the equipment after installation has been completed.
- C. Testing:
 - 1. Set time delays and sensing control wiring for automatic start/stop operation and time delays between transfer switches.
- D. Upon completion of the onsite tests, a general inspection shall be made for any deficiency which may impair proper operation.

3.3 ACCEPTANCE

- A. Final acceptance will not be granted by the Owner until onsite tests have been successfully completed, all defects in material or operation have been corrected, and operating and maintenance data has been submitted along with all completed test reports.

END OF SECTION

SECTION 26 4113

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.02 DESCRIPTION

- A. General: Provide design and installation of complete extensions and modifications to the existing building's lightning protection system as indicated on the drawings and as specified herein. Extend existing lightning protection system to new building components, equipment, etc. as required. The lightning protection system shall be installed by a firm presently engaged in installations of UL or LPI certified lightning protection systems. The system as completed shall comply with the latest edition of UL96A, Installation Requirements for Lightning Protection Systems, and NFPA-780 "Standard for the Installation of Lightning Protection Systems." The system shall meet all requirements of these standards and the Lightning Protection Institute Standard of Practice LPI-175. All components required for a UL or LPI certification shall be provided whether or not such materials are specifically addressed by the contract drawings or described herein.
- B. Qualification: All installers shall be experienced with installing UL and LPI certified systems or of equivalent qualification, as accepted in writing by the engineer of record. An LPI Certified Master Installer shall be on the project site at all times during installation of the systems and shall supervise all of the installation.

1.03 SUBMITTALS

- A. General: Shop drawings identifying all system wiring and component placement, including all details, shall be submitted to the Engineer for review. The Contractor shall not perform any portion of the Work until the respective submittal has been accepted. All work shall be in accordance with accepted submittals.
- B. Detail Submission: Details shall be submitted to the Engineer for review indicating the method of cabling connections and attachments starting at the top of the project building to the ground rods at the counterpoise. All details shall be appropriate for the project.
- C. Identification: All product data sheets submitted, for proposed system components, shall clearly identify the item being submitted and shall indicate the UL label.
- D. Deviations: The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the acceptance of

shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal and the Engineer has given written acceptance to the specific deviation.

- E. Certification: Provide documentation of an LPI-175, NFPA-780, or UL-96A Certification from the LPI-IP Inspection Program or a UL Master Label upon completion of project.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Labels: All materials used for the system installation shall comply in size, composition and weight to all requirements of NFPA, U.L. and LPI for the class of system in which they are installed. All materials shall be labeled or listed by Underwriters Laboratories, Inc. for use in LPI certified lightning protection systems.
- B. Material: Generally, the external lightning protection system at the roof level shall be constructed of copper cable and copper compatible components. The internal lightning protection system, starting with the down conductors and concluding at the ground termination system shall be constructed of copper cable and copper compatible components. Likewise, all bonding conductors, equipotential loop conductors, etc, shall also be constructed of compatible cable and components.
- C. Compatibility: All portions of the system, whether copper or aluminum, shall be galvanically compatible to the building material to which they are to be attached. Connections between copper and aluminum portions of the system shall be made with appropriate bimetallic coupling devices. In all areas, the conductor shall be supported to maintain clearance from all galvanically incompatible materials or shall be of the same material if permitted within these specifications.
- D. Components: All system components (i.e. air terminals, bases, connectors, cable, thru-roof fittings, ground rods, etc.) shall be, to the maximum extent possible, the product of a single manufacturer. All components shall be Class I or II as required by NFPA 780 or as noted. All air terminal bases shall be securely mounted to the building structure by means of mechanical fasteners. Adhesive type air terminal bases are acceptable only where hard setting epoxy adhesive is utilized, where mechanical fastening is prohibited by the roofing manufacturer and where acceptable to the code authority having jurisdiction. Submit shop drawings for all proposed air terminal mounting details.

2.02 AIR TERMINALS

- A. General: Air Terminals shall be copper or aluminum as required to match the building system to which they attach. Air terminals shall protrude a minimum of 10 inches above the object to be protected. Center roof terminals shall be 24" high. Air terminal points shall be blunt with the radius of curvature equal to the rod diameter.

- B. Base: Each air terminal shall be equipped with the correct type of base for the location in which it is mounted.
- C. Roof Top Equipment: Air terminals and interconnecting cable shall be provided for all roof mounted equipment (fans, A/C equipment, etc.) subject to a direct strike as required by NFPA 780 and as shown.

2.03 CONDUCTORS

- A. General: Main roof conductors shall be copper or aluminum unless otherwise specified or required and shall provide a two-way path from each air terminal horizontally or downward to connections with down conductors. Conductors shall be free of excessive splices and bends. No bend of a conductor shall form an included angle of less than 90 degrees nor have a radius of bend of less than 8 inches. Conductors shall be secured to the structure at intervals not exceeding 3 feet with approved fasteners. Cables connected to "thru-roof" connectors may rise from the roof to the connector at a maximum slope of 3 inches per foot, not exceeding 3 feet horizontally in air.
- B. Down Conductors: Down conductors shall be copper and shall be concealed in the exterior wall construction or structural columns. Where run in or on reinforced concrete columns, bond down conductor to the re-bar at top and bottom of column. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. If project structure is of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals averaging not more than 100 feet around the perimeter of the structure. Connections to the steel frame shall be made with heavy duty bonding plates having 8 square inches of contact surface or with exothermic welds.
- C. Shop Drawing: Submit all conductor types in shop drawings. Each conductor shall be identified as to location in the lightning protection system.

2.04 ROOF PENETRATIONS

- A. General: Roof penetrations required for down conductors or for connections to structural steel framework shall be made using pre-manufactured U.L. approved thru-roof type assemblies with solid rods, PVC sleeves and appropriate roof flashing. Roof flashing shall be compatible with the roofing system and shall be provided under this contract and installed by the roofing contractor. Submit roof flashing data sheets and letter of acceptance from roofing contractor in shop drawing package.

2.05 COMMON GROUNDING

- A. General: Common grounding of all ground mediums within the project building shall be made by interconnecting with main size conductors, fittings as required or exothermic welds.
- B. Bonding: Grounded metal bodies located within the required bonding distance (as determined by the bonding distance formulas in NFPA 780) shall

be bonded to the system using bonding conductors and fittings. Bond to rebar utilizing mechanical connections.

2.06 GROUND TERMINATIONS

- A. General: One ground termination shall be provided for each down conductor and shall consist of one $\frac{3}{4}$ " inch x 10 foot copper-clad ground rod. Each down conductor shall be connected to the ground rod by an exothermic weld connection. Tops of ground rods shall be located 2 feet below finished grade and 2 feet from the foundation wall and shall extend a minimum of 10 feet vertically into the earth. Where a counterpoise is provided, rods shall be interconnected with the counterpoise.
- B. General: Where the structural steel framework is utilized as the down conductor for the system, every other perimeter steel column shall be grounded but no more than 60 feet apart. Steel columns shall be grounded using bonding plates having 8 square inches of surface contact area or with exothermic welds. Conductors from the steel column connections to the ground terminations shall be full size copper lightning conductors.

2.07 FASTENERS

- A. General: Conductor fasteners shall be manufactured of a material which is compatible with the type of conductor being supported. Fasteners shall be of sufficient strength to properly support each conductor or terminal base, etc.

2.08 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Equipment manufactured by ERICO, INC or East Coast Lightning Equipment.
- B. Certified Installer: Utilize installer currently servicing existing facility. Coordinate with owner.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUCTORS

- A. General: Conductors shall be installed to interconnect all air terminals to the system of grounding electrodes, and in general provide a minimum of at least 2 paths to ground from any air terminal on the system. Conductors shall provide a horizontal or downward path between the system air terminals and grounding electrode system.
- B. Routing: Conductors shall be routed in such a manner that maximum concealment from public view is achieved. Down conductors may be installed in one-inch PVC conduit from roof to grade.
- C. Connections: All connections between conductors below grade shall be exothermically welded. Improper application of weld shall be replaced at no additional cost to the contract.

3.02 INSTALLATION OF GROUND RODS

- A. General: Ground rods shall be installed vertically at each down conductor position at a minimum of 2 feet from the building foundation wall. Inspection and documentation at each grounded location, weld, depth of counterpoise, etc., shall be made prior to backfill. Contractor shall notify engineer in writing to request inspection of underground work and for L.P.I. inspection before backfill. Allow a minimum of one week for engineer to make the inspection after notification from contractor.

3.03 BONDING OF SECONDARY METALLIC BODIES

- A. Structure Grounding: Provision shall be made at the roof level on reinforced concrete structures for bonding between the roof or down conductors, metallic elements of the roof system and metallic exterior wall systems.
- B. Bonding: All down conductors run in concrete columns shall be bonded to the reinforcing steel at the top and the bottom of the column.

3.04 GENERAL WORKMANSHIP

- A. General: All elements of the Lightning Protection System shall be installed in a professional and workmanlike manner consistent with the best industry practices.
- B. Concealed Installation: All system components shall be concealed to the maximum extent possible to preserve the aesthetic appearance of the project building on which the system is installed.

3.05 COORDINATION WITH OTHER TRADES

- A. Coordination: The Contractor shall coordinate his work with all trades, to insure the use of proper materials and procedures in and around the roof in order not to jeopardize the roofing warranty.
- B. Fasteners: Where fasteners are to be embedded in masonry or the structural system, they shall be coordinated to insure installation at the proper time of construction.
- C. Certification: Upon completion of the installation the Contractor shall provide to the owner the Master Label issued by Underwriters Laboratories, Inc. or an LPI-IP Master certification issued by LPI-IP.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Interior solid-state luminaires that use LED technology.
- 2. Emergency lighting units.
- 3. Exit signs.
- 4. Luminaire supports.

B. Related Sections:

- 1. Section 26 2726 "Wiring Devices" for occupancy sensors and manual wall box dimmers.
- 2. Section 26 0519 "Low Voltage Electrical Power Conductors and Cables" for wire and cabling.

1.3 SYSTEM DESCRIPTION

- A. Catalog numbers indicated in the Luminaire Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of light bar, driver, finish trim, ceiling type, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of LED's, wattage and/or size specified in the text description of each luminaire type. Additional features, accessories and options specified shall be included.
- B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling systems.
- C. Luminaire voltage shall match the voltage of the circuit serving same.

1.4 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.

- C. IP: International Protection or Ingress Protection Rating.
- D. LED: Light-emitting diode.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including lamp, reflector, and housing.

1.5 SUBMITTALS

- A. Product Data: For each type of luminaire, arranged in order of luminaire designation. Include data on features, accessories, finishes, and the following:
 - 1. Material and physical description of luminaire including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.
 - 4. Life, output (lumens, CCT, and CRI), Kelvin temperature, and energy-efficiency data for LED light bars.
 - 5. Low voltage transformers.
 - 6. LED power supplies.
 - 7. Types of LED's, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).
- B. Shop Drawings shall:
 - 1. Show detail of nonstandard or custom luminaires.
 - 2. Indicate dimensions, weights, method of field assembly, components, features and accessories.
 - 3. For custom luminaires, modified luminaires or linear luminaires mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths in runs, pendant or power feed locations, accessories, finishes and lists of materials.
 - 4. This Contractor shall provide the manufacturer with accurate field dimensions where required.
 - 5. Include wiring diagrams, power and control wiring.
- C. Wiring diagrams shall detail wiring for luminaires and differentiate between manufacturer installed and field installed wiring.
- D. Product Certificates shall be signed by manufacturers of luminaires certifying that products comply with requirements.
- E. Dimming Driver Compatibility Certificates shall be signed by the manufacturer of driver certifying that drivers are compatible with dimming systems and equipment with which they are used. Product Certificates signed by product manufacturer shall be provided for each type of driver for dimmer controlled luminaires.
- F. Maintenance Data shall be provided for luminaires and equipment to include in emergency, operation and maintenance manuals specified in specifications

section describing Operations and Maintenance Data.

- G. Field quality control test reports.
- H. Special Warranties specified in the Section.
- I. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition or quantities. This Contractor shall field verify voltage and actual mounting condition and method.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all arrays and drivers types used on Project; use ANSI and manufacturers' codes.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver luminaires individually wrapped in factory fabricated fiberboard type containers.
- B. Handle luminaires carefully to prevent breakage, denting and scouring of the luminaire finish.
- C. Store product in a clean, dry space, protected from weather.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. Designated manufacturers are listed to define the requirements for quality and function of the specified product.

1.9 COORDINATION

- A. Coordinate layout and installation of luminaires with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, and technology and partition assemblies.
- B. Provide all frames, supplementary support structures, hangers, spacers, stems,

aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation.

- C. Recessed luminaires shall have frames that are compatible with the ceiling system indicated on the Architectural Drawings.

1.10 WARRANTY

- A. Comply with Division 1 requirements.
- B. Warranty for LEDs' and Drivers: Manufacturers standard form in which manufacturer of LED's and drivers agrees to replace components that fails in materials or workmanship within specified warranty period.
 - 1. LED arrays: minimum of 5 years from date of Beneficial Occupancy.
 - 2. Drivers: minimum of 5 years from date of Beneficial Occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products as listed in the Lighting Fixture Schedule.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

- A. Recessed Luminaires: Comply with NEMA LE 4 for ceiling compatibility for recessed luminaires.
- B. Luminaires: Comply with UL 1598.
- C. Metal Parts: Free of burrs, sharp corners and edges. Metal work shall be free of tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with luminaire performance, maintenance or the seating of any luminaire element. Safety device shall not be visible during normal luminaire operation and from normal viewing angles.
- F. Luminaires provided shall have means for disconnection from power source during

service, as required in NEC Article 410.

G. Reflector cones shall adhere to the following:

1. Cones shall provide a minimum of 50 degree cutoff to source and source image.
2. Plastic material shall not be used for reflector cones.
3. Cones shall not be permanently fastened to the housing and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
4. Trim shall be flush to ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
5. Reflector cones shall be uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free from spin marks or other defects.
6. Manufacture cones using the Alzak® process. Refer to Luminaire Schedule for cone color and finish, i.e., specular or diffuse requirements.

H. Lenses, Covers, Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100% virgin acrylic plastic. UV stabilized high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. Lenses shall have uniform brightness throughout the entire visible area without LED pixelation.
2. Glass Globes: Annealed crystal glass unless otherwise indicated.

I. Adjustable luminaires shall have positive locking devices to fix aiming angle. Luminaires shall be capable of being relamped without adjusting aiming angle.

J. Each luminaire that has an array with a beam pattern or a spread lens that defines beam orientation shall contain locking devices to insure the orientation is not disturbed during array replacement or cleaning.

K. All luminaires and drivers shall operate within the temperature limits of their design and as specified by UL in the applications and mounting conditions specified.

L. Luminaires recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.

M. Provide plaster frame for recessed luminaires mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering luminaires.

N. Fixtures installed in "hard" ceilings shall have all connections accessible through the luminaire.

- O. For weatherproof or vapor-tight installations, finishes of luminaires and accessories shall be a premium 5 stage TGIC polyester powder coat paint minimum 2.5 mils thick, applied to factory- assembled and -tested luminaires before shipping, so that the entire assembly is completely corrosion resistant for the service intended. Exterior finishes shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion. Where aluminum parts come in contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.
- P. Luminaires for use outdoors or in areas designated as damp locations shall be suitable gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.
- Q. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when light bars are in place.
- R. Luminaires shall be free of light leaks while providing sufficient ventilation of LED's and drivers to provide the required photometric performance.
- S. Luminaires shall hold LED arrays securely against normal vibration and maintenance handling.

2.3 LUMINAIRES

- A. Housing shall be minimum code gauge steel construction painted after fabrication with high reflectance white paint unless otherwise indicated.
- B. Shielding shall adhere to the following criteria:
 - 1. Flat frosted diffuser shall be 100% virgin acrylic, pattern #12, and shall have matte finish on exterior side. Diffuser shall be of sufficient density to completely obscure LED image.
 - 2. Flat clear lenses shall be injection molded 100% virgin acrylic.
 - 3. Clear patterned lenses shall be injection molded 100% virgin acrylic, pattern #12.
 - 4. Clear patterned lenses shall be polycarbonate, pattern #12.
 - 5. Minimum thickness shall not be less than 0.125" with a minimum weight of 8 ounces per square foot.
- C. Doorframes shall be supplied with concealed hinges and latches. Provide mitered corners with no gaps or light leaks.

2.4 EMERGENCY BATTERY PACK FOR LUMINAIRES

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within/top of luminaire body and compatible with driver. Comply with UL 924.
 - 1. Indicator light: Visible without opening luminaire or entering ceiling space. Indicator Light: LED indicates normal power on.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type, sized for ninety

- (90) minutes of operation.
- 3. Charger: Fully automatic, solid-state.
- 4. Integral Self-Test: Factory-installed electronic device automatically initiates code required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- 5. Universal Voltage input.

2.5 LED LUMINAIRES AND DRIVERS

A. All Luminaires

- 1. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
- 2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
- 3. Comply with In-Situ testing for more reliable results.
- 4. LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
- 5. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours. (L70)
- 6. LED luminaires shall deliver a minimum of 80 lumens per watt.
 - a. LED's shall be "Bin No. 1" quality.
- 7. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
- 8. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
- 9. LED color temperatures: 4000 as noted, +/- 275K.
- 10. Luminaires shall have internal thermal protection.
- 11. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
- 12. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
- 13. Color maintenance over rated life shall be within .007 of CIE 1976.
- 14. Indoor luminaires shall have a minimum CRI of 85.
- 15. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
- 16. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
- 17. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

B. Power Supplies and Drivers

- 1. Power Factor: 0.90 or higher
- 2. Maximum driver case temperature not to exceed driver manufacturer recommended in- situ operation.
- 3. Output operating frequency: 60Hz.
- 4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.

5. Total Harmonic Distortion Rating: 20% Maximum.
6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
7. Fully dimmable, 0 – 10 VDC standard.
8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
9. Compatibility of dimming switches: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

2.6 LED ARRAYS

- A. All LED's of the same type are to be provided by the same manufacturer.
- B. Equip each luminaire with the proper LED array of the type shown or specified in the Luminaire Schedule

2.7 WIRING

- A. No internal wiring shall be visible at normal viewing angles.

2.8 LUMINAIRE SUPPORT COMPONENTS

- A. Single-Stem Hangers shall be 1/2-inch steel tubing with swivel ball fitting and ceiling canopy.
Finish shall be the same as the luminaire.
- B. Twin-Stem Hangers shall be two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the luminaire.
- C. Rod Hangers shall be 3/16-inch minimum diameter, cadmium-plated threaded steel rod.
- D. Wires shall be ASTM A 641/A 641M, Class 3, soft temper, zinc coated steel, 12 gauge.
- E. Wires for humid spaces shall be ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel, 12 gauge.
- F. Aircraft Cable Support shall use cable, anchorages, and intermediate supports recommended by luminaire manufacturer.
- G. Hangers for pendant industrial luminaires shall be heavy duty No. 8 jack chain with hangers, "S" hooks, mounting straps, and all required accessories for complete installation.

2.9 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with Authorities Having Jurisdiction. Provide ten additional exit signs as required to be installed where required by the AHJ (provide all costs associated with installation).

B. Internally Lighted Signs:

1. Products: Provide products as listed in the Lighting Fixture Schedule.
2. Red Letters.
3. Directional chevrons as indicated.
4. *Field selectable full size arrow designations.*
5. Light bars: LED, 70,000 hours minimum rated lamp life.
 - a. Individual LED modules shall not be visible.
7. *Maximum power consumption: 5 watts.*
8. AC powered signs shall be 120/277V input.
9. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. LED, 70,000 hours minimum rated lamp life.
 - b. Battery: Two hour capacity sealed, maintenance-free, Ni Cad type, five year manufacturer warranty.
 - c. Charger: Fully automatic, solid-state type with sealed transfer relay.
- d. Operation: 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 light bars from battery, and battery is automatically recharged and floated on charger.
- e. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- f. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- g. Integral Self-Test: Factory-installed electronic device automatically initiates code- required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.10 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Flexible cord and plug connections shall not be permitted.
2. Battery: Sealed, maintenance-free, lead-acid type.
3. Charger: Fully automatic, solid-state type with sealed transfer relay.
4. Lamping: LED
5. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Wire Guard: Heavy-chrome-plated wire guard to protect lamp heads or units in areas where subject to physical damage.
9. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes

- when power is restored after an outage.
10. Integral Self-Test: Factory-installed electronic device automatically initiates code- required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Luminaires:

1. Set level, plumb, and square with ceilings and walls, and secure according to manufacturers written instructions and approved submittal materials, unless otherwise indicated.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, and reinstall.

C. Remote Mounting of Drivers: Distance between the driver and fixture shall not exceed that recommended by manufacturer. Verify, with manufacturers, maximum distance between driver and luminaire.

D. Mounting height indicated from finished floor to bottom of pendant luminaire or to the center of the outlet box for wall mounted luminaires unless otherwise noted. Verify mounting heights with Architect and Lighting Designer.

E. Mounting height may also be indicated as the length of the pendant below finished ceiling.

F. Lay-in Ceiling Luminaire Supports: Use grid as a support element.

1. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4- inch metal channels spanning and secured to ceiling tees. In addition, provide slack safety wire hangers secured diagonally from opposite luminaire corners to structural members above suspended ceiling.

G. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
5. Where pendants or rods are longer than 48", brace to limit luminaire swinging.

H. Provide all necessary hanging or mounting devices and accessories for all

luminaires. Verify the types needed for various ceiling conditions. Plaster rings shall be provided where required.

- I. Verify weight and mounting method of all luminaires prior to ordering and provide suitable support. Coordinate with General Contractor for luminaires that require additional blocking or support. Luminaire mounting assemblies shall comply with all local seismic codes and regulations.
- J. Metal decking shall not be pierced for luminaire support.
- K. Refer to architectural reflected ceiling plans for coordination of luminaire locations with mechanical, fire protection, technology and fire safety equipment. Where conflicts occur, coordinate with Architect and Engineer prior to installing any of the Systems.
- L. In accessible suspended ceilings, luminaire wiring connections, including equipment grounding conductor, is to be through use of 72-inch (maximum) flexible conduit from a rigidly supported junction box.
- M. Wire per requirements of branch circuit installation. Properly ground each luminaire.
- N. Luminaires located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling. Acoustical ceiling tiles are not acceptable.
- O. Install luminaires with vent holes free of air blocking obstacles.
- P. This Contractor shall be responsible for adjusting aperture flanges or rings on all recessed luminaires to be flush with the finished ceiling. Trim shall completely conceal ceiling opening.
- Q. Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.
- R. Wall mounted luminaires shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 1/4-inch toggle bolts for gypsum board walls or 1/4-inch bolts to pre-set inserts for concrete wall.
- S. Luminaires shall not be secured to ductwork or other Systems.
- T. Adjust variable position lampholders for proper lamp position prior to luminaire installation.
- U. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 DOWNLIGHT LUMINAIRES

- A. Recessed Type in Accessible Ceilings: Mount in frames suitable for the ceiling with the recessed portion of the luminaire securely supported from the ceiling opening by use of a metal trim ring.

- B. Recessed Type in Non-accessible Ceilings: As Specified for mounting in accessible ceilings, except provide access to wiring and driver through the ceiling opening for the luminaire.

3.3 LUMINAIRES

- A. Recessed Type: Support luminaires independent of the ceiling suspension system. Provide four integral tabs (one at each corner) which rotate into position and lock on ceiling tees after luminaire is lifted into the ceiling cavity or provide four clips similar to Caddy #535. Provide mounting frames suitable for the ceiling type. In addition, provide slack earthquake safety wire hangers secured diagonally from opposite luminaire corners to structural members above suspended ceiling.
- B. Wall Mounted Type: Support from four-square outlet box plaster ring and from wall at non-feed end with two ¼ inch toggle bolts for gypsum board walls or ¼ inch bolts to pre-set inserts for concrete wall.
- C. If clearance above T-bar system is too restricted to "tip-in" luminaire, coordinate with acoustic ceiling installer by leaving one cross T-bar off until the cross T-bar shall be secured into its proper place. Luminaires installed in hidden-spline-type ceilings shall have supporting channels installed by Ceiling Contractor to adequately support the luminaire without providing additional hangers from the structural ceiling above the suspended ceiling.
- D. Surface Mounted Type:
 - 1. Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
 - 2. Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/ joints shall be tightly fitted.
- E. Pendant Mounted Type:
 - 1. Provide strong back channel entire luminaire length unless luminaire is designed specifically to be self-supporting.
 - 2. Where suspended below accessible ceiling, provide structural support at suspended ceiling level from structural members above ceiling. Do not run hanger rods through ceiling.
 - 3. Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/joints shall be tightly fitted.
 - 4. All power feeds shall originate from the same location/end of each run.
- F. Install luminaire diffusers only after construction work, painting and clean up are completed.

3.4 LED LUMINAIRES

- A. Adhere to manufacturers installation guidelines regarding proper thermal management.

3.5 LIGHTING CONTROL

- A. Provide branch circuiting in coordination with the requirements of Division 26 Wiring Device Section and as indicated.

3.6 CLEANING AND ADJUSTING

- A. Remove protective plastic covers from luminaires and luminaire diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty reflectors and diffusers.
- B. Clean luminaires internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.
- C. Make final adjustment of aimable luminaires and adjustable light settings under the direction of the Architect and/or Lighting Designer during a scheduled period of time prior to the completion of the Project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.
- D. Luminaires, reflectors, louvers and accessories which are damaged, blemished, or impregnated with fingerprints shall be replaced at this Contractor's expense. All finishes shall be unmarred upon Project completion.

3.7 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery/generator and retransfer to normal. Walk test and verify foot-candle levels meet Code with meter.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- C. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- D. Replace all inoperable LED arrays at the end of construction prior to Owner's beneficial occupancy.
- E. Malfunctioning Luminaires and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

END OF SECTION 26 5100

SECTION 27 00 00

COMMUNICATIONS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies the basic requirements for communications and low voltage installations as indicated or required, and includes requirements common to more than one specification section of this Division (such as related documents, related sections, definitions, governing requirements, contractor requirements, warranty requirements, submittal requirements/procedures, and project closeout requirements/procedures, as well as other requirements). This section may expand upon and/or supplement the requirements specified in Division 1.

1.2 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General, Supplementary and other conditions, and the requirements of other Divisions apply to the work of this Division.
- B. Examine the Contract Documents in their entirety (including Drawings and Specification Sections in the other Divisions) for requirements or work which may affect work under this Section, regardless of whether such requirements or work are specifically indicated in this Section.

1.3 RELATED SECTIONS

- A. All Division 27 Specification Sections in this Bid Package
- B. The applicable portions of the Governing Requirements (see Part 1 - General: Governing Requirements, herein) shall be incorporated by reference into each related Specification Section.

1.4 QUALIFICATIONS

- A. See Division 1 requirements for contractor general qualifications.
- B. Where manufacturer supports an authorized distributor program, products shall be purchased through an authorized distributor. Provide manufacturer's letter of authorization.
- C. Where manufacturer supports a certified installer program, products shall be installed by a certified installer company using certified installers. Provide certification documents.

1.5 COMMUNICATIONS AND LOW VOLTAGE SYSTEMS

- A. The following communications and low voltage systems are included within this Division:

1. Communications Structured Cabling System
2. All other systems utilizing the communications infrastructure

- B. Most, if not all, of these systems will be procured and provided under separate contracts, directly by the owner. However, some infrastructure components and some interface components of related systems covered in these specifications may be contracted through the general contractor. See entire set of documents for responsibilities.

1.6 INTENT AND INTERPRETATIONS

- A. It is the intent of the Construction Documents that the Contractor shall include all items necessary for the proper execution and completion of the Work by the Contractor, resulting in complete and fully operational system(s) ready for the Owner's use, in full compliance with all applicable standards, codes and ordinances.
- B. Work or product not specifically indicated in the Construction Documents, but which are necessary to result in complete and fully operational system(s) ready for the Owner's use, shall be provided by the Contractor.
- C. The specification of certain products in the Construction Documents shall not be construed as a release from furnishing such additional products and materials necessary to furnish complete and fully operational system(s) ready for the Owner's use.
- D. In the event that discrepancies exist or required items or details have been omitted in the Construction Documents, the Contractor shall notify the Consultant in writing ten (10) days prior to the bid date. Failure to do so shall be construed as willingness to provide a complete and fully operational system within the amount bid by the Contractor. Where such discrepancies are not brought to the attention of the Consultant, the most stringent requirements shall be construed to be the basis for the Contractor's bid.
- E. Prior to bidding the project, the Contractor shall visit the site to determine all existing conditions affecting the work, the type of construction to be used, and the nature and extent of work provided by other trades. Failure to do so shall be construed as willingness to provide complete and fully operational system(s) within the amount bid by the Contractor. Site visit to be coordinated with Owner/general contractor.
- F. Cable tray and cable pathway loading is the responsibility of the contractor. Contractor shall ensure that no cable tray is filled more than 50% visible fill. This shall be based upon the actual ability of the tray to "fit" cable, not its loading capacity in terms of weight the tray can support. In the event that discrepancies exist, the contractor shall notify the Consultant as described above. Failure to do so shall be acknowledgement by the contractor that the cable tray in all areas will meet the 50% rule and any additions of cable that may be required during construction shall be at no additional cost to the Owner.
- G. Drawings and Specifications are complementary. Items required by either are binding as though they are required by both. In the event of conflict between the requirements of the Drawings and the Specifications:
- H. With regards to the preparation of proposals and/or bids, the Contractor shall assume the more stringent (costly) condition shall prevail. The Contractor shall notify the Consultant of such a minimum ten (10) days prior to the bid date.

- I. With regards to actual construction, the Contractor shall notify the Consultant and await the Consultant's instruction prior to proceeding with procurement and installation.
- J. The Construction Documents include certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions include:
 - K. Abbreviated Language: Language used may be abbreviated. Implied words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpreted as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable and where the full context so dictates.
 - L. Imperative and Streamlined Language: Imperative and streamlined language is used generally. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 - M. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context.
 - N. Words used in the singular shall also mean the plural, wherever the context so indicates, and likewise words in the plural shall also mean the singular, wherever the context so indicates.
 - O. Unless otherwise stated, words which have well known technical or construction industry meanings are used in accordance with such recognized meanings.
 - P. The terms "directed," "required," "permitted," "ordered," "designated," or "prescribed," as well as similar words shall mean the direction, requirement, permission, order, designation or prescription of the Consultant.
 - Q. The terms "approved," "acceptable," "satisfactory," and similar words shall mean approved by, acceptable, or satisfactory to the Consultant.
 - R. The terms "necessary," "reasonable," "proper," "correct" and similar words shall mean necessary, reasonable, proper, or correct in the judgment of the Consultant.
 - S. Assignment of Specialists: The individual Specification Sections may require that certain specific construction activities be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and such assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling the contract requirements shall remain with the Contractor.
 - T. This requirement shall not be interpreted to conflict with the enforcement of local building codes and similar regulations governing the work.
 - U. Drawings:
 - 1. Drawings are diagrammatic and approximate in character, are not intended to show all features of required work, and do not necessarily indicate every required component.
 - 2. Symbols used on the Drawings are defined in the legend on the Drawings. Symbols indicated on the legend may not necessarily be required.

1.7 DEFINITIONS

- A. The definitions below are applicable to this Division. These definitions expand upon and/or supplement the definitions specified in Division 1. In the event of discrepancies between these definitions and those defined in Division 1, the definitions in Division 1 shall take precedence.
- B. Accepted/Acceptable: Work or materials conforming with the intent of the project, and in general, conforming to the pertinent information in the Construction Documents.
- C. Approved/Approval: The written approval of the Consultant.
- D. Accessible: Easy access. Access attained without requiring extensive removal of other materials to gain access.
- E. Accessible Ceiling: Acoustical tile hanging ceilings ("Hard-lid" ceilings (concealed spine or sheetrock/gypsum ceilings), even when provided with access panels, are not considered an Accessible Ceiling).
- F. Agreement: The contractual agreement between the Owner and the Contractor.
- G. Communications Infrastructure System: A Communications Cabling System (see Communications Systems, herein) combined with a Communications Raceway System (see Communications Systems, herein).
- H. Concealed: Hidden from sight in interstitial building spaces, chases, furred spaces, shafts, crawl spaces, etc.
- I. Construction Documents: Collective term for the entire set of bound or unbound material describing the construction and services required, including all Drawings, Specifications, addenda issued prior to execution of the contract, and modifications issued after execution of the Contract (such as change orders, construction change directives, supplemental instructions, etc.).
- J. Contract Documents: The Agreement (including other documents listed in the Agreement), Conditions of the Contract (General, Supplementary and other conditions), and the Construction Documents.
- K. The Contract: The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the Owner and the Contractor and supersedes any prior negotiations, representations or agreements, either written or oral. The Contract shall not be construed to create a contractual relationship of any kind (1) between the Consultant and the Contractor, (2) between the Owner and a Subcontractor, or (3) between any persons or entities other than the Owner and Contractor.
- L. Contractor: The party responsible for providing the system(s) as indicated herein.
- M. Drawings: The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including (but not limited to) plans, elevations, sections, details, schedules and/or diagrams.
- N. Engineer/Consultant: The party responsible for producing the communications system(s) Construction Documents.
- O. Exposed: Not concealed (see above) and not installed underground
- P. Final Completion: The date when the Consultant confirms in writing that the Contractor has completed the work in accordance with the Construction Documents, including completion of all punch list items, cleanup work and delivery of all required guarantees, warranties, licenses, releases and other required deliverables.

- Q. Furnish: To purchase, supply, and deliver to the project materials in new and operable condition, ready for installation.
- R. Governing Requirements: Collective term for regulations, laws, ordinances, codes, rules, standards, requirements, and guidelines that govern the installation and inspection of the work defined in the Contract Documents. See Part 1 – General: Governing Requirements herein. S. Governing Authorities: Entities or their representatives charged with formation and/or enforcement of Governing Requirements, such as the Authority Having Jurisdiction (AHJ). T. Install: To place in final position in fully operable, tested condition.
- U. Inside Plant (ISP): Infrastructure within a building.
- V. Or Equal: Materials approved for use by the Consultant and which are dimensionally suitable and operationally identical to the specified item.
- W. Outside Plant (OSP): Infrastructure exterior to a building.
- X. Owner: The Owner and the Owner’s designated representative(s).
- Y. The Project: 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/or separate contractors.
- Z. Provide: To furnish and install, complete, tested and ready for intended use.
- AA. Substantial Completion: The date when all work required by the Construction Documents shall be complete (subject to the final punch list to be prepared by the Consultant) and on which the applicable jurisdictional authorities have issued a temporary certification of occupancy.
- BB. Section: An individual section of the Specifications.
- CC. Shown on Drawings: Noted, indicated, scheduled, detailed, or any other written reference made on the Drawings.
- DD. Specifications: The portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work and performance of related services.
- EE. Specification Section(s): One or more sections of the Specifications.
- FF. Section(s): An abbreviated form of Specification Section(s).
- GG. Structured Cabling System (SCS): Alternative term for Communications Cabling System
- HH. The Work: The construction and services required by the Contract Documents, whether completed or partially completed, and 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.

1.8 ABBREVIATIONS

- A. Refer to the individual Specification Sections and Drawings for abbreviations and their definitions.

1.9 GOVERNING REQUIREMENTS

- A. All work shall be executed in compliance with the latest version and applicable portions of the codes, regulations, standards, guidelines, and/or recommendations of the following (hereinafter referred to as Governing Requirements):

1. General

- a. ACI: American Concrete Institute (www.aci-int.org)
- b. AHJ: Authority Having Jurisdiction
- c. ANSI: American National Standards Institute (www.ansi.org)
- d. ASTM: American Society for Testing and Materials (www.astm.org)
- e. ASME A17.1: Safety Code for Elevators and Escalators
- f. BICSI: A Telecommunications Association (www.bicsi.org)
- g. IBC: International Building Code
- h. ICEA: Insulated Cable Engineers Association (www.icea.net)
- i. IEEE: Institute of Electrical and Electronic Engineers (www.ieee.org, standards.ieee.org)
- j. IES: Illuminating Engineering Society of North America (www.iesna.org)
- k. FCC: Federal Communications Commission Rules and Regulations
- l. NAB: National Association of Broadcasters
- m. NFPA: National Fire Protection Association (www.nfpa.org)
- n. NEC: National Electrical Code (NFPA Article 70) (www.nfpa.org, www.necdirect.org)
- o. NESC: National Electrical Safety Code (<http://standards.ieee.org/nesc/>)
- p. NEMA: National Electrical Manufacturers Association (www.nema.org)
- q. OSHA: Occupational Safety and Health Administration (www.osha.gov)

2. Communications Specific:

- a. ANSI/TIA-568-C: Commercial Building Telecommunications Cabling Standard
- b. TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces
- c. TIA-570-B: Residential Telecommunications Infrastructure Standard
- d. ANSI/TIA-606-AB: Administration Standard for Commercial Telecommunications Infrastructure
- d. J-STD-607-CB: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- e. ANSI/TIA-758-BA: Customer-owned Outside Plant Telecommunications Infrastructure Standard
- f. ANSI/TIA: Technical Service Bulletins (TSBs) (related to the above ANSI/TIA standards)
- g. IEEE 802.3: Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit and 802.3ae and 802.3an 10 Gigabit Ethernet Standard
- h. BICSI: BICSI Customer Owned Outside Plant Design Manual
- i. BICSI: BICSI LAN and Internetworking Design Manual
- j. BICSI: BICSI Telecommunications Distribution Methods Manual
- k. BICSI: BICSI Telecommunications Cabling Installation Manual
- l. NEC: NFPA 70
- m. NFPA 75: Protection of Electronic Computer and Data Processing

- Equipment Standard for the Fire Protection of Information Technology Equipment
 - n. NFPA 780: Lightning Protection Code Standard for the Installation of Lightning Protection Systems
 - o. FCC Part 68: Connection of Terminal Equipment to Telephone Network.
 - p. FCC Part 76.611: CFR Title 47 Radiation Cable Television Basic Signal Leakage Standards
 - q. FCC Title 47: Telecommunication
- B. Work shall comply with the Governing Requirements in effect at the time of construction, including all addenda, errata, annexes, and technical service bulletins (TSBs), etc., except where a specific date or version is otherwise indicated, or where otherwise mandated by a Governing Authority.
- C. In the event of conflict between the Governing Requirements and/or conflict between the Governing Requirements and the Construction Documents:
- 1. With regards to the preparation of proposals and/or bids, the Contractor shall assume the more stringent (costly) condition shall prevail. The Contractor shall notify the Consultant of such a minimum ten (10) days prior to the bid date.
 - 2. With regards to actual construction, the Contractor shall notify the Consultant and await the Consultant's instruction prior to proceeding with procurement and/or installation.
 - 3. In the event of conflict between a code and a non-code Governing Requirement, or between a code and the Construction Documents, the code shall govern. However, compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the non-code Governing Requirement or Construction Documents which may be in excess of code requirements and not contrary to same.
 - 4. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.
 - 5. Errors or omissions in the Construction Documents do not relieve the Contractor from executing the work in accordance with the Governing Requirements.
- D. The Governing Requirements are incorporated by reference into these Specifications.

1.10 PERMITS AND FEES

- A. The Contractor shall obtain and pay for all licenses, permits and inspections required by the laws, ordinances and rules governing work specified herein. Such fees shall be included in the bid amount.

- B. The Contractor shall schedule and coordinate all inspections of the work as required, and shall provide all assistance as required by the inspector(s) during their inspection(s).
- C. The Contractor shall pay all fees, including but not limited to fees for local utility service installation, connection charges, etc. Such fees shall be included in the bid amount.

1.11 SUBSTITUTIONS AND DEVIATIONS

A. Substitutions and deviations shall be in accordance with the applicable portions of Section 012500. The requirements below expand upon and/or supplement the requirements in Section 012500. In the event of discrepancies between these requirements and those defined in Section 012500, the requirements of Section 012500 shall take precedence.

B. Prior to award of contract:

1. Bids shall be based on products and methods of construction as specified.

a. Substitution of product and deviations from the methods of constructions specified which are used in the Contractor's bid shall be at the sole risk of the Contractor, and as such are subject to rejection without consideration during submittal review, should the Contractor be awarded the contract.

C. After award of contract:

1. Proposed substitution and deviation requests shall be reviewed during the time of Submittal review.

a. Conditions for Consideration: Substitution and deviation requests will be received and considered only when one or more of following conditions are satisfied:

- 1) The specified product or method of construction cannot be provided within the contract period.
- 2) The specified product or method of construction cannot receive necessary approval by a Governing Authority, and the requested substitution can be approved.
- 3) The specified product or method of construction cannot be provided in a manner that is compatible with other materials.
- 4) A substantial advantage is offered to the Owner, in terms of cost, time, or other considerations of merit.
- 5) The product as specified includes the statement "Or Equal/Equivalent."

b. Conditions for Rejection: Substitution and deviation requests will be rejected for the following reasons, among others:

- 1) The conditions for consideration (see above) have not been met.

- 2) Extensive revisions to the Construction Documents are required to support the proposed changes.
- 3) The proposed changes do not comply with the general intent of the Construction Documents.
- 4) The substitution request is for product which does not include the statement, "Or Equal/Equivalent," or is specified as "no substitute," "substitutions are not acceptable," "provide as specified" or similar.
- 5) The proposed change is solely for the convenience or economic gain of the Contractor.

2. Approval of substitution and deviation requests

- a. The Contractor shall not proceed with a substitution or deviation without written approval.
- b. The Contractor shall be responsible for fees incurred by the Consultant for any redesign resulting from the proposed changes, and for the updating of the Construction Documents to reflect such changes.

1.12 SUBMITTALS

A. Submittals shall be in accordance with the applicable portions of Section 013300. The requirements below expand upon and/or supplement the requirements in Section 013300. In the event of discrepancies between these requirements and those defined in Section 013300, the requirements of Section 013300 shall take precedence.

B. General:

1. Submittal review is a courtesy extended to the Contractor for the limited purpose of checking for general conformance with the design concept and the information shown in the Construction Documents.
2. The Contractor shall provide submittal information as soon as practicable after the date of Notice to Proceed and prior to the purchase, delivery, fabrication, and installation of product.
3. In the event of discrepancies or conflict between Submittals and the Construction Documents, either prior to or after review, the requirements of the Construction Documents shall prevail.
4. Submission of material for review, regardless of the outcome of the review, does not alter the Contractor's obligation to follow the intent of the Construction Documents, nor the Contractor's responsibility to comply with the Construction Documents.
5. Submittals will not be reviewed and will be returned to the Contractor without review for the following reasons:
 - a. Submittal package does not conform to the requirements listed herein.
 - b. Submittal is for a product or method of construction not required by the Construction Documents.
 - c. Submittal is partial or incomplete.

- d. Submittal contains information concerning the proposed implementation of means, methods, procedures, sequences or techniques, temporary aspects of the construction process, or other items, which are the sole responsibility of the Contractor.
 - e. Submittal was not carefully reviewed by the Contractor prior to submission, as evidenced by poor organization, obvious or numerous errors, lack of correlation or cross-referencing, lack of clarity in presentation, or containing Shop Drawings which do not meet the standard of the Construction Drawings.
 - f. Submittal was submitted directly from the Contractor's subcontractor(s) or vendor(s).
 - g. Subcontractor and/or vendor submittal information was not carefully reviewed and/or approved by the Contractor.
 - h. Submittal does not bear the Contractor's approval stamp, and/or contains subcontractor and/or vendor submittal information which does not bear the Contractor's approval stamp.
 - i. Submittal contains substitution and/or deviation requests, which are not clearly identified as substitution or deviation requests in a separate "Substitution and Deviation Requests" section of the Submittal.
- 6. Submittals shall be submitted as a single package and shall include subcontractor and vendor submittal information.
 - 7. Each submittal (or re-submittal) set shall bear a unique Contractor's submittal sequence number.
 - 8. Requests for substitution shall only be included under the "Substitution and Deviation Requests" section of the submittal (see below) and shall comply with the requirements of Part 1 – General: Substitutions and Deviations herein. Submission of substitution requests in any other portion of the Submittal does not constitute an acceptable or valid request for substitution, nor will review of such information constitute approval in any manner.

C. Submittal Format:

- 1. Submittals shall be in electronic PDF format for output in one letter-sized (8-1/2 x 11 inch) document and under separate cover from submittals furnished under other Divisions.
- 2. Front cover of Submittal shall indicate the name of the project, the project number, the name of the Owner, year of completion, the title "Telecommunications Submittals," and the names of the Consultant and Contractor, as well as the General Contractor.
- 3. Submittals shall include a table of contents identifying sections, specification sections, and page numbers.
- 4. Information provided in the submittal shall follow the same general order of the Specifications.
- 5. Submittals shall be sectionalized and indexed with titled tab dividers (by section name – not numbered and not handwritten).

- a. Sections shall be (see Submittal Sections below for more detail regarding each section):
 - 1) Product Data
 - 2) Shop Drawings
 - 3) Technical Drawings (if applicable)
 - 4) Samples (if applicable)
 - 5) Substitution and Deviation Requests (if applicable)
 - 6) Other Information (if applicable)
 - b. Within each section, information shall be organized by Specification Section and/or Drawing to which the information applies.
6. Pages shall be numbered.
 7. Quantity: Submit copies in quantities per the requirements of Section 013300.
 8. Submittal Sections: Submittals shall be sectionalized and shall include sections for Product Data, Shop Drawings, Technical Drawings, Samples, Substitution and Deviation Requests, and Other Information (see Submittal Format herein).
- D. Product Data: Submit Product Data information as called for in the individual Specification Sections. Product Data shall include:
1. For all products provide the following product information (as applicable):
 - a. Specification Section to which the product applies.
 - b. Catalog cut sheets, manufacturer data sheets, and/or specification sheets detailing the product, item, assembly and installation. **Note: Cut sheets covering multiple products and options shall have arrows or highlights indicating which product or option is being submitted and crossouts of non-applicable information.**
 - c. When the specifications include product descriptions, model numbers, part numbers, etc. that have been superseded, changed, or discontinued, the Contractor shall submit a comparable substitution for review with a note indicating purpose of substitution.
 - d. Compliance with recognized trade association and testing agency standards.
 - e. Highlighted details within the product data that identifies compliance with the Construction Documents or the intent of the Construction Documents.
 - f. Highlighted details within the product data that identifies deviations from the Construction Documents or the intent of the Construction Documents.
 2. For products for which the Contractor is proposing a substitution, include the product as specified in the submittal per the above requirements and list the reference to the proposed substitution in the "Substitution and Deviation Requests" section of the submittal (see below).

3. Do not provide product quantities (except where requested in RFP as backup) – quantities are the sole responsibility of the Contractor, are not part of the contract, and will may not be reviewed.
- E. Shop Drawings: Submit Shop Drawings as called for in the individual Specification Sections. Shop Drawings shall include:
1. Shop drawings shall contain design details, fabrication installation drawings, detailed drawings, schedules, diagrams, templates and other drawings that show adaptation or installation of products. Shop Drawings shall include the following information:
 - a. Specification Section(s) to which the Show Drawing applies.
 - b. Dimensions.
 - c. Identification of products and materials included.
 - d. Compliance with specified standards.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Notation of details that identifies compliance with the Construction Documents or the intent of the Construction Documents.
 - h. Notation of deviations from the Construction Documents or the intent of the Construction Documents.
 - i. Indication of sectionalized manufacturing of equipment (i.e. for oversized equipment that cannot be installed as a single component).
 2. Shop drawings shall be provided in electronic PDF format and in form, format and size identical to that of the Construction Drawings (the Construction Drawings set the standard). **Note: Shop drawings that are prepared at a resolution making them unreadable when zoomed in to a normal reading size are not acceptable.** Shop Drawings that do not meet this standard shall be rejected without review.
 - a. Title Block: May be the Contractor's Title Block, but shall indicate Project name, manufacturer's name and logo, date of submittal, content of sheet, and sheet number.
 - b. Floor Plans: Plan titles, scales, north arrows, column lines, line types, fonts, and room names and numbers shall match that of the Construction Drawings.
 3. For methods of construction for which the Contractor is proposing a deviation, include the method of construction as specified per the above requirements and list the reference to the proposed deviation in the "Substitution and Deviation Requests" section of the submittal (see below).
- F. Technical Drawings: Submit Technical Drawings as called for in the individual Specification Sections.
- G. Samples: Submit Samples as called for in the individual Specification Sections.

1. Samples shall be indexed in this section and provided as an attachment to the Submittal.

H. Substitution and Deviation Requests: For each substitution and/or deviation request, include the following:

1. Whether the request is for substitution of product or deviation from a construction method.
 2. The Specification Section(s) or Drawing to which the request applies.
 3. Reason for the request (Note: the reason must conform to the requirements of Part 1 – General: Substitutions and Deviations herein)
 4. If a substitution, provide:
 - a. Specified product to which the proposed substitution applies.
 - b. Product Data for the substituted product.
 - c. Notation of differences between the proposed substitution and the specified item.
 5. If a deviation, provide:
 - a. Specified method of construction to which the proposed deviation applies.
 - b. Shop Drawing data for the deviation.
 - c. Notation of differences between the proposed deviation and the specified construction method.
 6. Written statement signed by the Contractor stating that the proposed substitution or deviation is equivalent or superior in function, appearance, and quality to the specified product or construction method and that the proposed substitution or deviation will be at no additional cost to the Owner.
- I. Other Information:
1. Provide the following at time of bid:
 - a. Hubbell Premise's Mission Critical certificate stating that the Cabling Contractor is in good standing with the Hubbell Premise Mission Critical certified installer program.
 2. Provide all applicable portions of the following information within 10 days after award of Subcontract:
 - a. Project schedule in PDF format. Include, at a minimum, major tasks, milestones, dependencies, and durations for each task.
 - b. Work with the General Contractor to merge this schedule into the overall construction schedule.
 - c. Provide the following information for materials, components, and equipment to be furnished by the Contractor:

- 1) Descriptive literature, manufacturer's specification data sheets, and manuals.
 - 2) Individual price and delivery schedules.
 - 3) Manufacturer's product test data with indicator arrows.
 - 4) Final Performance testing criteria and data for communications distribution system cabling systems
3. Submit Other Information as called for in the individual Specification

I. Submittal review:

1. The submittal review will not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of work with other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor.
2. Corrections or comments made on the Submittal by the reviewer during the submittal review do not relieve the Contractor from compliance with the requirements of the Construction Documents.
3. Review of a specific item shall not indicate that the reviewer has reviewed the entire assembly of which the item is a component.
4. Review does not relieve the Contractor from responsibility for errors, which may exist in the submitted data.
5. Review of substitutions and deviations:
 - a. The reviewer shall not be responsible for review of substitutions and/or deviations that were not brought to the attention of the reviewer by specific inclusion of the substitution and/or deviation in the Substitution and Deviation Requests section of the Submittal.
 - b. Where a substitution and/or deviation is not included in the Substitution and Deviation Requests section of the Submittal, the procurement and installation of the substitution and/or deviation is at the sole risk of the Contractor.
 - c. If the Reviewer does not specifically note substitutions and/or deviations, it remains the Contractor's responsibility to comply with the Construction Documents.
6. After review, submittals shall be returned together with review comments and specific actions (if required) to be taken by the Contractor. Typical comments and actions will be:
 - a. No Exceptions Taken
 - b. Revise And Resubmit - Re-submittal Required
 - c. Make Corrections Noted - Re-submittal not Required
 - d. Submit Specified Items
 - e. Rejected
 - f. Submittal Not Required & Not Reviewed

7. The Contractor shall perform no portion of the Work requiring a submittal until the respective submittal has been approved by the Architect/Consultant/general contractor. Such Work shall be in accordance with the approved submittal.
8. Re-submission of submittals:
 - a. Submittals shall continue to be re-submitted and reviewed until all submitted items are marked by the Consultant as "No Exceptions Taken" or "Make Corrections Noted (Re-submittal Not Required)."
 - b. Re-submittals shall be clearly identified as a re-submittal and shall identify changes on a separate Revisions page inserted after the Table of Contents page(s).
 - c. The Contractor shall be responsible for fees incurred by the Consultant resulting from subsequent review of re-submittals that fail to meet the requirements herein. Such fees will be incurred after the Consultant has reviewed the original submission and one re-submission.

1.13 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in full compliance with the manufacturer's recommendations and/or instructions, using means and methods that will prevent damage, deterioration, and loss (including theft).
- B. The Contractor shall protect product until final acceptance.
- C. Protection of product is the sole responsibility of the Contractor. The Contractor shall be responsible for replacing damaged, deteriorated, or lost product at no additional cost to the Owner.
- D. Products subject to damage by the elements shall be stored above ground, under cover, in a weather tight enclosure, with ventilation adequate to prevent condensation. Temperature and humidity shall be maintained within the manufacturer's recommendations.
- E. The Contractor shall make provisions for receiving and storing product, including Owner furnished product to be installed by the Contractor as part of the work.
- F. Product shall be carefully inspected for damage upon delivery. Defective or damaged product shall be marked "Rejected," removed from the site, and shall not be installed.
- G. The Contractor shall arrange product deliveries in accordance with the construction schedule. Deliveries shall be scheduled to maintain the progress of work, to avoid conflict with the work of other Trades, and to accommodate site conditions.
- H. Product shall be delivered to the site in the manufacturer's original containers, complete with labels and instructions for the proper handling, storage, unpacking, protection and installation.
- I. The Contractor shall ensure that product to be installed is not temporarily used as steps, ladders, platforms, scaffolds, or for storage by the Contractor or by other Trades during the construction process. Equipment found to be used in such a manner will be considered "damaged," shall not be installed, and shall be replaced at no additional cost to the Owner.

1.14 WARRANTY

A. Contractor Warranty: Provide a Contractor endorsed and backed warranty against all defects in materials and workmanship, in compliance with the applicable requirements of Division 1.

1. All labor and materials attributable to the fulfillment of the warranty (including Contractor administrative costs) shall be provided at no cost to the Owner.
2. Defects in materials and workmanship shall be remedied within 72 hours of discovery and Contractor notification (or as indicated below.)
3. The Warranty period shall be a minimum of 1 year and shall commence upon Final Completion of the work.

B. Manufacturer Warranty: Provide Manufacturer Warranty(s) (per system type) as follows:

1. Communications Cabling System:

- a. The Cabling Contractor shall be a fully approved Hubbell Mission Critical certified installer and:
 - 1) Shall be responsible for workmanship and installation practices in accordance with the Hubbell Mission Critical certified installer Program.
 - 2) Shall have 30% of their technicians trained on copper installations and testing by Hubbell Premise. Hubbell Premise will extend the Mission Critical 25-year Static, Dynamic and Applications warranty to the owner.
 - 3) The Mission Critical warranty requires that the channel be completed with a qualified Mission Critical warranty partner. Berk-Tek copper cabling products are qualified as a Mission Critical partner by the Mission Critical Warranty.
- c. Provide labor, materials and documentation according to Hubbell Premise requirements necessary to insure that the Owner will be furnished with the Hubbell Mission Critical 25 year warranty.
- d. All necessary documentation for warranty registration shall be furnished immediately following 100% testing of all cables and must be provided to Hubbell Premise.
- e. Administer the warranty process with the responsible manufacturer's representative. The warranty shall be provided directly to the owner from the manufacturer. Insure that the manufacturer provides the Owner with the appropriate warranty certification within 30 calendar days of the final project completion.
- f. Transfer any additional manufacturer's warranties to the owner in addition to the above-mentioned warranties. Submit these warranties on each item in list form with any applicable shop drawings. Detail

specific parts within equipment that are subject to a separate conditional warranty or warranties.

g. In addition to the standard warranty requirements, provide the following during the warranty period:

h. Within 24 hours after notification of a defect, the Cabling Contractor shall start to make the necessary corrections and inform the appropriate Project Manager of the planned corrective actions. The Cabling Contractor shall follow this initial contact with continuous effort and complete any required corrective work within 15 days after notification.

2. Other Systems: Provide a minimum 2-year Manufacturer extended product, performance/application, and labor warranty UNLESS a different time period is provided within the specific specifications.

C. The Manufacturer warranty period shall commence upon a Warranty Certificate being issued by the manufacturer.

1. The Warranty Certificate shall be included with the O&M Manual submission. O&M Manual's submitted without the Manufacturer's Warranty Certificate will be rejected without review.

1.15 COORDINATION

A. The Contractor shall thoroughly examine the Construction Documents, including Drawings and specification Sections of other Divisions, for construction details and methods that are dependent upon or will affect the work of other trades. The Contractor is responsible for identifying coordination issues and dependencies, and for preparing Shop Drawings, work plans and schedules to accommodate and/or mitigate coordination issues and dependencies before they arise.

B. Changes necessitated by the failure of the Contractor to coordinate with the work of other trades shall be at no additional cost to the Owner.

C. The Contractor shall confer and cooperate with the other trades, throughout the entire construction process, in order to coordinate the work in the proper sequence. Typical coordination issues include but are not limited to:

1. Electrical work, including electrical receptacles, power panels, transformers, telecommunications grounding system, and the installation of raceway, device boxes, conduits, and sleeves for the Communications Cabling System.
2. Mechanical work, including HVAC systems and ductwork, piping, and mechanical chases.
3. Ceiling cavity spaces.
4. Installation of acoustical ceiling tiles and similar finishes that may conceal the work.
5. Required separation distances.
6. Access routes for equipment through the construction.
7. Cutting/coring of floor, ceiling or wall structures.

D. The Contractor shall coordinate communications service installations with the Owner and any Service Provider(s).

- E. Existing communications service outages shall be coordinated and scheduled in advance with the Owner at a time and duration acceptable to the Owner. Outages scheduled at times other than the normal working hours shall not entitle the Contractor to additional compensation beyond the original amount bid. Outages without advance notice and prior approval by the Owner are not acceptable.
- F. The Contractor shall review the Drawings and Specifications of other Divisions for locations of devices and equipment requiring communications connectivity not specified in this Division or shown on the Communications Drawings. The Contractor shall coordinate the locations of these items with the other trades, and shall verify locations with the Consultant and Owner prior to rough-in.
- G. Verify that the physical dimensions of each item of equipment fit the available space, promptly notify the Consultant of any potential conflicts, and await the Consultant's direction prior to purchase and rough-in of the equipment.
- H. Coordinate locations of devices, outlets, etc. with field conditions, unless such locations are specifically dimensioned or otherwise noted in the Construction Documents. If so noted, verify location with other affected trades and against existing field conditions, promptly notify the Consultant of any potential conflicts, and await the Consultant's direction prior to purchase and rough-in of the equipment.
- I. Coordinate locations for chases, slots, sleeves, and openings in the building structure. For new concrete coordinate, locate and provide chases, slots, sleeves, and openings prior to the pouring of the concrete.
- J. Coordinate communications installations' impact on code or manufacturer required access to equipment of other trades. Propose solutions to any conflicts prior to rough-in of communications equipment or support infrastructure.

1.16 RECORD DOCUMENTS

A. The Contractor shall maintain a set of Record Documents showing all additions, changes, and deletions that have been made to the original Drawings and Specifications throughout the course of construction, as well as reviewed Submittal data.

B. Items to be noted shall include but shall not be limited to:

- 1. Routing of concealed raceways/pathways;
- 2. Raceways/pathways located more than 2 feet from where shown on the original Contract Documents;
- 3. Raceways and main pathways (pathways with more than 30 cables) not shown on the Contract Documents;
- 4. Concealed equipment;
- 5. Stubouts; actual equipment locations, sizes and dimensions;
- 6. Addenda, accepted Alternates, Change Orders, other document revisions which occurred after the award of the Contract and/or the start of construction activities;
- 7. System component labels and identifiers for all major components.

C. Notations shall be handwritten in a neat and legible manner and shall be noted as follows:

1. Red – for additions and changes
2. Green – for deletions
3. Blue – for notes

D. Record Documents shall:

1. Be kept current (i.e. no more than one (1) week behind actual construction) throughout the course of construction.
2. Be retained at the job site until Final Acceptance.
3. Be made readily available at all times to the Owner's representative.
4. Not be the Contractor's working documents.
5. Be made readily available to the Consultant for review of completeness and accuracy throughout the course of construction.
6. At project closeout, be updated with the items on the Known Exceptions/Deviations List per the requirements of Part 3 – Execution: Project Close-Out. Include only those items marked "Approved" by the Consultant.
7. Submission: The Record Drawings shall be submitted to the Consultant as part of the Operations & Maintenance Manual (see Part 1 – General: Operations and Maintenance Manual herein).
8. Handwritten notations on the Record Drawings shall be CAD drafted by the Contractor onto a final, fresh set of Construction Drawings prior to submission. Record Drawings shall be provided in form, format, size, and CAD version identical to that of the Construction Drawings (the Construction Drawings set the standard). Record Drawings that do not meet this standard shall be rejected without review.
9. The Record Drawings shall be reviewed by the Contractor for accuracy and completeness prior to submission
10. The record drawings shall be submitted in accordance with the applicable portions of Section 017839.

1.17 OPERATING AND MAINTENANCE (O&M) MANUALS

A. General:

1. O&M Manuals shall be submitted in accordance with the applicable portions of architectural specifications.
2. O&M Manuals shall be submitted as a single package and shall include subcontractor and vendor O&M information.
3. O&M Manual Requirements: O&M Manuals shall include Product Data, Service, Spare Parts, Tests/Measurements/Calibration Settings, Record Drawings, Warranty information, and Other Information as required.
 - a. Product Data: Include the product data provided in the Submittal reflecting product as supplied and installed, as well as additional information such as installation, operation, and routine maintenance information.
 - b. Service: Assemble service information (cleaning, adjustments, frequency, etc.) for each device requiring service. For devices requiring

- qualified service, compile an index of qualified service providers (and their contact information) able to service these devices.
 - c. Spare Parts: Assemble a list of spare parts. Compile an index of spare parts providers (and their contact information) able to provide the spare parts.
 - d. Tests: Assemble all test documentation made for each system and/or device requiring testing.
 - e. Record Drawings: Provide Record Drawings per the requirements of Part 1 – General: Record Documents herein.
 - f. Warranty: Provide warranty documentation.
4. O&M Manual contents shall be submitted in soft/electronic copy via email, USB drive or file sharing software/website.
- B. O&M Manual submission:
- 1. The Contractor shall submit one draft copy of the O&M Manual for review and approval by the Consultant in PDF format
 - a. The submission will be reviewed for accuracy, completeness, and compliance to the requirements herein. A submission which fails to meet these requirements will be rejected and returned to the Contractor together with review comments and specific actions to be taken by the Contractor. The Contractor shall revise the O&M Manual and re-submit for review and approval.
 - b. The O&M Manual shall continue to be re-submitted and reviewed until such time as the O&M Manual is approved by the Consultant.
 - c. The Contractor shall be responsible for fees incurred by the Consultant resulting from subsequent review of O&M Manuals that fail to meet the requirements herein. Such fees will be incurred after the Consultant has reviewed the original submission and one re-submission.
 - 2. Upon approval of the draft copy, the Contractor shall submit final copies to engineer.
 - 3. Final payment to the Contractor will not be authorized until the final copies of the O&M Manuals (including Record Documents) have been received and approved by the Consultant.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Where products from several manufacturers are listed under a specified component:
- 1. The products list shall be listed in alphabetical order by manufacturer name
 - 2. Products not listed first shall be considered equal and there is no manufacturer preference of those listed as acceptable.

B. If no product is listed, then any manufacturer able to meet the listed specifications is acceptable.

C. Where product is specified without the statement "or equal" and/or "or equivalent," substitutions will not be entertained.

2.2 MATERIALS

A. The Contractor is responsible for providing all incidental and/or miscellaneous tools, scaffolding, consumable items, testing equipment appliances, and other hardware not explicitly specified or shown on the Drawings required for the installation of a complete and operable telecommunications infrastructure system ready for the Owner's use.

B. Products shall be:

1. New (except as otherwise indicated) and free from defects.
2. Standard products of manufacturers regularly engaged in the production of such products.
3. Of the manufacturer's latest standard design.
4. Designed to ensure satisfactory operation and life in the environmental conditions that prevail in their installation location.
5. For products of similar type, provide products manufactured by a single manufacturer.
6. Where systems are indicated, provide component products manufactured by a single system manufacturer.

C. Prior to ordering and delivery of equipment, the Contractor shall:

1. Verify that the equipment shall adequately pass through building openings and passageways with unobstructed access to the final equipment location. When building openings and passageways will not permit the equipment to pass through unobstructed, equipment shall be manufactured and shipped in sections for final assembly at the equipment location. Submittals shall indicate sectionalized manufacturing of equipment.
2. Verify that the equipment shall properly fit the space allocated, that required clearances can be maintained, and that the equipment can be located without interference from other systems, structural elements, or the work of other trades.

PART 3 - EXECUTION

3.1 GENERAL

- A. All contractor personnel shall be clearly identified by uniform and/or company badge with photo ID, employee's name, and company name. Contractor vehicles shall be equipped with signs on both sides of vehicle identifying the Contractor's company name.
- B. All Owner provided Contractor IDs shall be returned at or before project closeout.

- C. Installation shall be in a neat and workmanlike manner employing workers skilled in the trade, familiar with the particular techniques and methods of construction applicable to the work of the trade.
- D. Completed work shall present a neat and professionally installed appearance. The appearance of the work shall be of equal importance to its operation. Failure to present a neat and professionally installed appearance shall be considered sufficient reason for rejection of the system in part or in whole.
- E. Completed work shall demonstrate quality workmanship. Quality workmanship shall be of equal importance to its operation. Failure to demonstrate quality

workmanship shall be considered sufficient reason for rejection of the system in part or in whole.

- F. The Contractor shall order and install materials and equipment with long lead times and/or those having a major impact on work by other trades so as not to jeopardize the project or project schedule.
- G. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances, and Governmental Requirements, including but not limited to employee training and Safety Program development, documentation and execution.

3.2 PERMITS AND FEES

- A. The Contractor shall make arrangements to obtain and pay for necessary permits, licenses, and inspections.
- B. No work shall be started prior to obtaining necessary permits and payment of required fees. Work installed prior to obtaining proper permits shall, if required by the Governing Authority (AHJ), be redone in compliance with requirements at no additional cost to the Owner.

3.3 INSTALLATION

- A. Install product according to manufacturer recommendations, except where local codes or regulations take precedence.
- B. Installation shall comply with the applicable portions of the Governing Requirements (see Part 1 – General: Governing Requirements).
- C. Dimensions and clearances:
 - 1. Equipment dimensions and dimensions indicated for the installation of equipment are restrictive dimensions. Verify that the equipment will fit within the indicated locations and spaces.
 - 2. Maintain, at a minimum, code required clearances.
 - 3. Promptly notify the Consultant of any potential dimension or clearance conflicts, and await the Consultant's direction prior to purchase and rough-in of the equipment.
- D. Access:

1. Install equipment such that it is readily accessible for operation and maintenance.
 2. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.
 3. Do not install equipment such that it interferes with the normal operation or maintenance requirements of other equipment.
 4. Equipment shall be installed level, plumb, parallel, and perpendicular to building structures and to other building systems and components, except where otherwise indicated.
 5. Equipment shall be securely fastened. Select fasteners so that the load applied to any one fastener does not exceed 25 percent of the proof-test load.
 6. Place equipment labels and/or other identification where the label and/or identification can be easily seen and read without difficulty.
- E. Attachment of hanger rods, support cables, diagonal wall bracing, and any other connections made to the building structure after the fireproofing contractor has completed his work, shall be made with minimal impact to the existing fireproofing. The Contractor making such connections is responsible for (a) removal of firestopping where attachment is required and (b) scorings and over-cut as required for connection only. Contractor shall be held responsible for costs associated with the patch back of excessively removed firestopping material.

3.4 REFERENCES AND STANDARDS

- A. Work shall comply with the Governing Requirements listed in Governing Requirements herein.

3.5 DRAWINGS

- A. Drawings shall not be scaled for rough-in measurements or equipment locations. Field verification of dimensions, locations, and levels to suit field conditions is required. Final placement of devices, outlets, equipment, etc. shall be coordinated with field conditions.

- B. Unless specifically dimensioned or detailed, Drawings indicate approximate locations, arrangement, and general character. To avoid interference with structural members and equipment of other trades, or for the convenience of the Owner, it may be necessary to adjust the locations shown on the Drawings prior to installation. Unless specifically dimensioned or detailed, and with the exception of locations of equipment and raceway in Telecommunications Rooms, the Contractor may make minor location adjustments without obtaining the Consultant's prior approval. All other adjustments require prior approval from the Consultant.

- C. Minor adjustments are defined as distances not to exceed:

1. 3 foot at grade, floor ceiling, and roof level in any direction in the horizontal plane.
2. 3 foot on walls in a horizontal direction within the vertical plane.

D. Particular attention shall be paid to door swings, piping, ductwork, and structural steel:

1. In general, waste and vent lines, large pipe mains, and ductwork shall be given priority for the locations and spaces shown.
2. In general, electrical lighting fixtures shall be given priority for ceiling space.

E. Where minor location adjustments are required, such adjustments shall be made at no cost to the Owner.

3.6 PENETRATIONS, PATCHING AND PAINTING

- A. Penetrations (openings, holes, chases, sleeves, slots, cuts, etc.):
- B. Properly size and locate penetrations required as construction progresses. For new concrete or masonry the Contractor shall coordinate, locate and provide required openings prior to the pouring of concrete or construction of masonry.
- C. Obtain written approval from the Structural Consultant/Architect for penetration of structural elements prior to penetration.
- D. Penetration of concrete and structural elements shall be avoided where possible. Where not possible, penetrations shall be performed in a manner that will not reduce structural element load-carrying capacity or load-deflection ratio.
- E. Penetrations shall be performed by workers qualified and skilled in the trades involved.
- F. Penetrations shall not be exposed on the exterior or in occupied spaces in a manner that would, in the Consultant's opinion, reduce the aesthetic qualities of the structure or result in visual evidence of penetration and patching.
- G. Penetrations shall be constructed using methods least likely to damage elements to be retained or adjoining construction.
 1. Provide temporary support for the work to be penetrated.
 2. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not for hammering or chopping. Cut holes and slots neatly to required size with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring of existing finished surfaces.
 4. Cut through concrete and masonry using a cutting device such as a Barborundum saw or diamond core drill.
- H. Voids around penetrations shall be properly sealed, caulked or grouted as required.
- I. Firestopping: Penetrations (through and membrane) of fire rated barriers shall be firestopped and sealed.
 1. The fire rating of the barrier shall be maintained.
 2. Material shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally

accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.

J. Existing elements:

1. The Contractor shall be responsible for identifying, locating, and protecting existing embedded conduits, pipe, ductwork, etc. when penetrating existing structures.
2. Cap, valve, plug or seal remaining portions of cut pipes or conduit to prevent entrance of moisture or other foreign matter.
3. The Contractor shall be responsible for repairing and/or replacing existing conduits, pipe, ductwork, etc. damaged by the Contractor during construction of penetrations. Repair and/or replacement shall be at no additional cost to the Owner.

K. Penetrations (and subsequent patching) resulting from the Contractor's failure to properly coordinate penetrations shall be at no additional cost to the Owner.

L. Patching:

1. Patching in every instance consists of completing the work to match and blend with the adjoining existing work insofar as methods, materials, colors, and workmanship are concerned
2. Patching shall be performed by workers qualified and skilled in the trades involved.
3. The Contractor shall be responsible for replacing improperly matched, blended, or poorly constructed patches at no additional cost to the Owner.

M. Painting:

1. Painting shall consist of cleaning, surface preparation, painting (primer, intermediate, and finish) and finishing surfaces and items, new and existing, affected by the work of the Contractor.
 - a. Surface painting shall match and blend with existing adjoining surfaces.
 - b. Scratched, chipped, or otherwise marred equipment shall be repainted to match original finish.
 - c. The areas around penetrations, once sealed, shall be painted.
2. Painting shall be performed by workers qualified and skilled in the trades involved.
3. The Contractor shall be responsible for refinishing and repainting improperly matched, blended, or poorly painted surfaces and items at no additional cost to the Owner.

3.7 HOUSEKEEPING

A. During the course of construction:

1. Comply with General Contractor and Owner requirements for site operations including work area cleaning and debris removal
2. At the conclusion of each day's work, remove empty boxes, crates, and other debris, and sweep clean all work areas affected by the Contractor's work of the day.

B. At project completion:

1. Remove all tools and scaffolding.
2. Equipment and facilities shall be thoroughly cleaned inside and out and residue removed.
3. Remove temporary labels and adhesives.
4. Thoroughly vacuum the interior of enclosures to remove debris.
5. Surplus product, materials and debris shall be cleared from the job site.
6. The Contractor is solely responsible for the appropriate disposal of all surplus product, materials and debris.

3.8 PROJECT CLOSE-OUT

- A. Notice of Substantial Completion: When the Work nears Substantial Completion, the Contractor shall notify the Consultant in writing the date that the work will be Substantially Complete and ready for review by the Consultant.
- B. Punchlist: Once notice of Substantial Completion is received, the Consultant shall visit the site to review the Work, and shall prepare a punchlist of items determined to be incomplete, deficient or otherwise not in compliance with the intent of the Contract Documents.
- C. The Contractor shall perform corrective action for each item noted in the punchlist. When complete, the Contractor shall submit the original punchlist with each item initialed attesting to the fact that the item was corrected.
 1. If necessary, the Consultant will perform a subsequent review after receipt of the Contractor initialed punchlist.
- D. Provide O&M Manuals per the requirements of Part 1 – General: Operating & Maintenance (O&M) Manuals.

3.11 FOLLOW UP

- A. After the system(s) and facility have been placed in operation and are in use by the Owner, provide technical assistance for the first three weeks of operation on a standby basis for troubleshooting, education, and problem solving.

END OF SECTION

SECTION 27 0528

COMMUNICATIONS RACEWAYS, PATHWAYS, AND GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and requirements of other Divisions apply to the work of this Section.

1.2 SUMMARY

- A. This Section includes requirements for interior raceways, pathways, and grounding specific to supporting the communications infrastructure system.
- B. The requirements of this Section are additional to, different from, or otherwise supplement the requirements of Division 26. The requirements of Division 26 shall serve as the basis for the requirements of this Specification Section.

1.3 REFERENCES AND STANDARDS

- A. The applicable portions of the Governing Requirements (see Division 26) shall be incorporated by reference into this Specification Section.
- B. The applicable portion of the latest version of the following codes, standards, and specifications shall be incorporated by reference into this section:
 - 1. ANSI/NFPA 70 – National Electrical Code (NEC)
 - 2. ASTM A 123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 3. ASTM A 510 – General Requirements for Wire Rods and Course Round Wire, Carbon Steel
 - 4. ASTM B 633 – Electrodeposited Coatings of Zinc on Iron and Steel
 - 5. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
 - 6. NEMA VE 2-2000 – Cable Tray Installation Guidelines
 - 7. UL 2043 – Standard for Fire Test for Heat and Visible Smoke Release for Discrete
 - 8. Products and their Accessories Installed in Air-Handling Spaces
 - 9. UL 2239 – Conduit, Tubing and Cable Support Hardware
 - 10. IEC 61537 – Cable Tray Systems and Cable Ladder Systems for Cable Management
 - 11. J-STD-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

1.4 QUALITY ASSURANCE

- A. Pre-installation meeting: The Contractor shall set up and attend a pre-installation meeting to discuss and review the telecommunications raceway/pathway layout, work, and installation guidelines a minimum of 30 days prior to beginning

raceway/pathway installation. Attendees shall include the General Contractor, the Contractor, relevant subcontractors, the cabling system(s) Contractor(s), the Architect, and the Engineer. The purpose of the meeting shall be to coordinate work between the trades and to ensure a consistent layout for all cabling systems, minimize interference, and to ensure that the cabling systems are accessible to the Owner for future modifications and maintenance.

- B. Cable Tray: The Drawings indicate the general route of the cable tray system. Data presented on these Drawings is as accurate as preliminary planning can ascertain until final equipment selection is made. Exact routing, locations, distances and levels will be governed by actual field conditions. The Contractor shall field verify exact routing, locations, distances, elevations, levels, dimensions, etc. prior to submitting coordination drawings (see Submittals, below).

1.5 SUBMITTALS

- A. Comply with 270100 – Communications General Requirements: Part 1 – General: Submittals. Provide submittal information for the following submittal sections as described below:

- 1. Product Data
- 2. Shop Drawings:

- a. Raceway/Pathway Routing Plan: Provide only if routing has not been shown on the Drawings, or if the Contractor is proposing a deviation.
- b. Cable tray: Detail fabrication and installation of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

- 3. Other Information:

- a. Cable Tray: Provide coordination drawings that include floor plans and sections drawn to scale. Fully dimension all cable tray components and lengths of runs. Determine exact layout and relationships between components and adjacent structural, electrical, and mechanical elements. Provide scaled floor plans showing all cable tray components including transitions, expansion joints, supports, firestopping and sound wall penetrations. Show clearances between mechanical ducts and piping.
- b. Raceway/Pathway Routing Plan: Provide only if routing has not been shown on the Drawings, or if the Contractor is proposing a deviation.

PART 2 - MATERIALS

2.1 GENERAL

- A. Product in this section is additional to, different from, or otherwise supplements the requirements of Division 26. The requirements of Division 26 shall serve as the basis for the requirements of this Section.

B. Products specified in this Section shall be UL Listed and Labeled.

2.2 BACKBOARDS

- A. Provide fire-rated backboards as shown on the Drawings. Backboards shall be 3/4-inch exterior grade Douglas Fir A-C plywood, void free, 2440-mm (8-ft) high unless otherwise noted, capable of supporting attached equipment, and painted with a minimum of two coats of fire retardant, non-conductive, light colored semi gloss paint. **Leave fire rating stamps unpainted.** Width shall be as required to cover walls fully. Provide plywood extensions to deck where cable pathways rise to floor above.

2.3 CONDUIT AND BOXES

A. Conduit:

1. Conduit types:

- a. Electrical Metallic Tubing (EMT): EMT shall be steel, hot-dipped galvanized or electro-galvanized, with an inner coating to protect cables and aid pulling, UL listed, and meeting the requirements of UL 797 and ANSI C80.3.
- b. Rigid Metal Conduit (RMC): RMC shall be steel, hot-dipped galvanized inside and outside with factory threaded ends galvanized after threading, UL listed, and meeting the requirements of UL 6 and ANSI C80.1.
- c. Rigid Nonmetallic Conduit (RNC): RNC shall be PVC Schedule 40 (unless otherwise noted) meeting the requirements of NEMA TC 2.
- d. Flexible (flex) conduit: Flex conduit is not approved and not acceptable.

2. Provide EMT except as noted below or as shown on the Drawings:

- a. Under slab/below grade:
 - 1) Provide RNC. When using RNC, transition to and provide RMC for all bends and stub-up locations.
- b. Embedded in concrete slabs (only in sizes and locations allowed by structural standards):
 - 1) At or below grade level: Provide RMC.
 - 2) Above grade level: Provide EMT or RMC.
 - 3) Through slab floors: Provide RMC.
- c. Hazardous areas:
 - 1) Provide RMC.
- d. Point of service extensions within the building for primary protection and non-indoor rated service cables.
 - 1) Provide RMC

3. Minimum conduit size, where not shown on the Drawings, shall be:

- a. From device boxes in walls: 1-inch.
- b. From pull boxes (fed by no more than three [3] 1-inch device box conduits) to telecommunications closets: 1-1/2 inch.
- c. From floor boxes: Varies – refer to symbols and abbreviations on the Drawings
- d. From poke-throughs: Conduit size shall be the same size as the conduit size of the poke-through.

B. Condulets (LB's):

1. Condulets (LB's) are not acceptable.

C. Innerduct

1. Underground conduit applications: Provide (2) Maxcell 4" 3-cell fabric innerduct in each indoor underground conduit. See drawings for additional requirements.

D. Device boxes: Device boxes shall be one piece (without welds or tab connections), with knockouts for conduit entrances, meeting NEMA OS 1, and with extension rings to suit construction and application.

1. Unless otherwise shown on the Drawings, provide device boxes as follows: Device boxes for communications outlets shall be minimum 4-11/16 x 4-11/16 inch (double gang), deep depth, with single gang extension rings. Combined depth of device box and extension ring shall be a minimum 3-1/2-inches.

E. Pull Boxes: Boxes shall be code gauge sheet metal/fabricated steel continuously welded at seams and painted after fabrication. Boxes shall be complete with covers, trim, etc.

1. Conduits shall only enter pull boxes from opposite ends and shall be sized appropriately for pulling cable. Pull boxes shall be sized as follows:

Maximum Trade Size Box Increase	Box End	Box Width	Box Additional Conduit	For Each Conduit of Conduit Width	Length	Depth
1"	4"	16"	3"	2"		
1-1/4"	6"	20"	3"	3"		
1-1/2"	8"	27"	4"	4"		
2"	8"	36"	4"	5"		

F. Floor Boxes/Poke-Through Devices:

1. Floor boxes (or Poke-through devices) may be combined with floor boxes used for power where shown on the Drawings. When combined, provided metal

dividers separating power from communications and provide separate conduits for power and communications.

2. Floor boxes shall be deep and square. Covers for floor boxes shall support carpet/floor trim to match surrounding floor area. Floor boxes shall be completed with matching pour boxes for installation in concrete slabs. Floor boxes shall be:

- a. Communications/Power Floor Boxes and poke-trough's (No A/V)

- 1) On-grade floor boxes: Wiremold RFB4E-OG series with different attachments for furniture feed or outlets.
- 2) Poke-Thru for furniture: Wiremold RC9AM2TCBK
- 3) Poke-Thru with outlets: Wiremold 6ATCBK 4) See drawings for exact configurations

- b. Communications/Audio-Visual/Power Floor Boxes and poke-trough's

- 1) AV On grade – Wiremold RFB11-OG series
- 2) AV Poke-thru - Wiremold 8ATCBK
- 3) See drawings for exact configurations

2.4 RACEWAY

A. Sizing: Raceway shall be sized as shown on the Drawings. Where not shown on the Drawings, raceway shall be sized according to the amount of cable it is to support per NEC and ANSI/TIA-569-D cable capacity standards, plus an additional 50% for future expansion. B. Sleeves: Provide sleeves where required for raceway and cable pass-through of building structures and/or fire/smoke rated barriers.

1. Through non-fire/smoke rated barriers/walls: Sleeves shall be EMT conduit and shall be complete with insulated throat bushings on each end. Sleeve type and size shall be according to the quantity of cable to pass through them per NEC fill ratios and the applicable ANSI/TIA standards.
2. Through fire/smoke-rated barriers/walls: Sleeves shall be an enclosed fire rated pathway device with a built-in fire sealing system sufficient to maintain the hourly rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or maintained without the need to remove or reinstall firestop materials. The pathway shall be capable of allowing a 0 to 100 percent visual fill of cables. Wire devices shall be of a sufficient size to accommodate the quantity and size of cables required. UL classified and or FM/Systems approved and tested to the requirements of ASTM E814 (UL1479). Sleeves shall be:

- a. Specified Technologies, Inc. EZ-Path.
- b. Note: Use shall be per local codes. Should local codes prohibit the use of this device, the Contractor shall provide sleeves per "non-fire rated barriers/walls" above and shall provide appropriate firestopping materials for such sleeves.

- c. In general, quantities of sleeves shall be provided as shown on the drawings or one 4" EMT sleeve for every 120 cables plus one **EZ-Path Series 44+** as a spare, whichever number is greater.
 - d. If a rated wall is penetrated with cabling and the sleeve is not shown on the drawings, the electrical contractor shall provide the specified sleeves to maintain the ratings of the walls.
 - e. The products shall be:
 - 1) Non-rated/Smoke rated walls: STI NEZ33 sleeve. Provide as kit NEZDP233 with gang plates. Denoted on drawings as (2) NEZ33 2)
Fire rated walls:
 - a) STI EZD33 sleeve. Provide with gang plates EZP233W. Denoted on drawings as (2) EZ33.
 - b) STI EZD44S sleeve. Provide with gang plates for (2) sleeves EZP144W and (4) sleeves EZG444. Denoted on drawings as (2) EZ44 and (8) EZ44.
3. Through floors: Sleeves shall be provided with insulated throat bushings on each end. Sleeves shall be:
- a. RMC conduit (quantities and sizes as shown on the Drawings)
- C. Cable Supports (J-Hooks, Straps): Provide cable supports suitable for the quantity of cables to be supported. Cable supports shall be complete with all incidental materials and assemblies required, including but not limited to mounting accessories to independently support supports from structure, extender brackets for mounting multiple hooks on a single support, clamps and fasteners, dedicated support wires, purlins and cable retainers as required. Supports, incidental materials, and cable retainers shall be plenum rated if used in a plenum environment, shall be listed to UL Standard 2239 and shall have the manufacturer's name and part number stamped on the part for easy identification. Supports shall be:
- 1. Wide Base Cable Supports (J-Hooks): Supports shall be wide-based with flared edges.
 - Provide larger sizes and multiple supports as required by cable quantities.
 - a. Erico CADDY CableCat 12/32
 - 2. Straps/Slings
 - a. Erico CADDY CableCat Adjustable Cable Supports
- Cable Tray:
- 1. Cable tray shall be "wire basket" type and constructed of welded wire mesh (high strength steel wires) with a continuous safety edge wire lip. Cable tray shall be complete with all materials and incidental and miscellaneous

hardware required for a complete cable tray system, including but not limited to support hangers, connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Cable tray shall have no sharp edges.

a. Cable tray shall be as follows:

- 1) Finish: Carbon steel with electro-plated zinc galvanized finish. 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.
- 2) Width: 18" wide minimum or as shown on the drawings.
- 3) Depth: 4 inch usable loading depth.
- 4) Mesh: 2 x 4 inch mesh pattern with intersecting wires welded together.
- 5) Fittings: Fittings shall be field fabricated through use of manufacturer's hardware and in accordance with manufacturer's instructions.
- 6) Vertical Transitions (Elevation Changes): Vertical transitions shall be field fabricated through use of manufacturer's hardware and in accordance with manufacturer's instructions.
- 7) Bends: Bends shall be field fabricated through use of manufacturer's hardware and in accordance with manufacturer's instructions.
- 8) Supports: Supports shall be trapeze style or wall brackets (center support hangers are not acceptable) and provided in quantities as recommended by cable tray manufacturer according to maximum load.
- 9) Support Hangers: Support hangers for trapeze style hangers shall be 1/4-inch or 3/8-inch diameter rods.
- 10) Splicing assemblies: Shall be bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 Stainless Steel.
- 11) Load rating: In accordance with NEMA VE 1.
- 12) Grounding/bonding: Cable tray shall be complete with manufacturer's hardware for grounding/bonding.
- 13) Seismic bracing: Provide to meet local codes.

b. Cable tray and all fittings and supports shall be manufactured by the same manufacturer and shall be:

- 1) Cooper B-line FlexTray, or 2) Cablofil, Inc.

2.5 FIRESTOPPING

- A. Firestopping material used to seal open penetrations through which cable passes shall be reusable/re-enterable; see Section 2.4B for applications and products. For applications not covered in Section 2.4B including existing sleeves, provide firestopping material for all through and membrane penetrations of fire-rated barriers.
- B. Provide through-penetration firestop products, fire-resistive joint system products, and perimeter fire containment system products 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 firestopping products manufacturer based upon testing and field experience.

- C. Provide firestop products that upon curing do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- D. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
- E. Products specified in this Section shall be UL Listed and Labeled.
Material shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.
 - 1. Materials shall be complete with necessary accessory materials, as applicable, for complete UL Listed and approved assemblies.
 - 2. Firestopping material shall be manufactured by: Hilti

2.6 GROUNDING AND BONDING

- A. Ground Busbars: Grounding busbars shall meet the specifications of J-STD-607-C and conform to BICSI recommendations, with standard NEMA bolt hole sizing. Grounding busbars shall be plated for reduced contact resistance.
 - 1. Primary Bonding Busbar (PBB): Provide as shown on the Drawings. Where not shown, provide a minimum of one PBB per main telecommunications room (i.e. TEF or TER). Busbar shall be:
 - a. CPI: 40153-020 (20-inches x 4-inches)
 - b. Erico: TMGB-A20L27PT (20-inches x 4-inches)
 - c. Or equal.
 - 2. Secondary Bonding Busbar (SBB): Provide as shown on the Drawings. Where not shown, provide a minimum of one SBB per each Technology Distribution Room (or IDF box). For large TDRs requiring more grounding connections, increase SBB size to match PBB size. Busbar shall be, at a minimum:
 - a. CPI: 40153-012 (12-inches x 4-inches)
 - b. Erico: TMGB-A12L15PT (12-inches x 4-inches)
 - c. Or equal.
 - 3. Rack Bonding Busbar (RBB): Provide an RBB for each metal enclosure including cabinets and racks. See Section 27 1100 Communications Equipment Room for specification.

B. Bonding Conductors:

1. Telecommunications Bonding Backbone (TBB): TBBs shall be solid copper conductor, unless stranded is required due to wire size and may be insulated (green). Unless otherwise noted on Drawings, TBB shall be sized according to conductor length based on TIA-607-C Table 1.
2. Bonding Backbone (BBC): BBCs shall be solid copper conductor unless stranded is required due to wire size and may be insulated (green). Unless otherwise noted on Drawings, conductors shall be sized, at a minimum, the same size as the largest TBB to which it is connected.
3. Telecommunications Bonding Conductor (TBC): Provide a stranded copper conductor sized, at a minimum, the same size as the largest TBB from the PBB to the Electrical Entrance Facility bonding point. The TBB may be insulated (green). Structural metal bonding conductors to the PBB or SBB shall be sized according to TIA607-C Table 1.

2.7 IDENTIFICATION AND ADMINISTRATION

A. Labels shall be permanent (i.e. not subject to fading or erasure) and permanently affixed.

Handwritten labels are not acceptable.

B. For identification of materials and equipment in the outside plant:

1. Labels shall be waterproof (even when submerged) and engraved on hard plastic markers. Lettering shall be black, markers shall be white.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work in this section is additional to, different from, or otherwise supplements the requirements of Division 26 Section. The requirements of Division 26 shall serve as the basis for the requirements of this Section.
- B. Work shall comply with the references and standards listed in Part 1 – General: References and Standards herein.

1. The Contractor shall pay particular attention to and comply with the following:

- a. ANSI/TIA-569-D: Commercial Building Standard for Telecommunication Pathways and Spaces
- b. ANSI/TIA-606-B: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- c. J-STD-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- d. NEC: Comply with the NEC as applicable to construction and installation of cable tray and cable channel systems (Article 392, NEC).

- e. NFPA: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to the installation of cable tray systems.
- 2. Installation shall be such that communications circuits, when installed in the raceway system, are able to fully comply with the following:
 - a. ANSI/TIA-568.0-D: Generic Telecommunications Cabling for Customer Premises
 - b. ANSI/TIA 568.1-D: Commercial Building Telecommunications Infrastructure Standards
 - c. ANSI/TIA 568-C.2: Balanced Twisted Pair Telecommunications Cabling and Components Standard
 - d. ANSI/TIA 568-C.3: Optical Fiber Components Standard

3.2 BACKBOARDS

- A. Mount backboards on walls in locations shown on the Drawings with base of backboard at +12-inches A.F.F to a height of 108 inches A.F.F., with the "A" side exposed. Attach backboards to wall studs along the entire length of the wall. Backboards shall be smoothly sanded, sealed and painted with a minimum of two coats of fire retardant, non-conductive, light colored semi gloss paint. **Leave fire rating stamps unpainted.** Provide plywood extensions to deck where cable pathways rise to floor above.

3.3 CONDUIT AND BOXES

A. Conduit:

- 1. Run conduit in the most direct route possible, parallel and perpendicular to building lines. Do not route conduit through areas in which flammable material may be stored, or over or adjacent to boilers, incinerators, hot water lines, or steam lines.
 - a. Conduit for station cabling: Total length of a given conduit run (from device box to telecommunications closet), including all intermediary conduits and pull boxes, shall not exceed 270 feet. Conduit runs shall contain no continuous sections longer than 150 feet. Provide intermediary pull boxes as necessary to comply with this requirement.
- 2. Conduit bends:
 - a. A conduit bend shall not exceed 90 degrees.
 - 1) Conduit bends shall be sweeping, shall conform to ANSI/TIA-569-D bend radius requirements, and shall be a minimum of no less than 10 times the internal diameter of the conduit.

- 2) For conduits larger than 1-½ inches, bends shall be factory-manufactured. Bending conduit larger than 1-½ inches in the field using manual or mechanical methods is not acceptable.
 - 3) The contractor shall test each conduit with a mandrel to prove compliance with the bend radius requirements throughout the conduit run and shall provide evidence of such testing immediately upon request of the Engineer.
- b. The sum total of conduit bends for a conduit segment between end points/pull boxes shall not exceed 180 degrees, except as noted below:
 - 1) One additional bend of up to 90 degrees is acceptable if the bend is located within 12 inches of the cable feed end.
 - c. 90 degree condulets (LB's) are not acceptable.
3. Conduit Stubs: Install conduit stubs where called out on Drawings.
- a. From device boxes in partition walls: Conduit stubs shall extend a minimum of 6 inches above top of partition wall and shall be angled 30 degrees toward the nearest raceway/pathway for station cabling.
 - b. From device boxes, pull boxes, floor boxes, and/or poke-throughs to cable tray: Terminate conduits 2 to 4 vertical inches above the tray and within 2 horizontal inches of the edge of the tray. Conduits shall not extend over the edge of the cable tray.
4. Ream conduits to eliminate sharp edges and terminate with metallic insulated throat bushings.
 5. Metallic conduits entering communication or equipment rooms shall be equipped with grounding lugs. Cap each conduit with a mechanical-type seal for protection.
 6. Equip all conduits over 3-feet long with a plastic or nylon pull string with a minimum test rating of 200 lb. Extend pull string a minimum of 3-feet from each end and securely tied in place.
 7. Terminate conduits that protrude through a floor 1 to 3 inches above the surface of the floor.
 8. Conduits entering through the floor of a telecommunications closet shall terminate 4 inches above the finished floor.
 9. When using RNC, transition to and provide RMC for all bends and stub-up locations.

B. Device Boxes:

1. Unless otherwise indicated, boxes shall be recessed. Set device boxes plumb, level, square and flush with wall. Do not exceed more than 1/16 inch tolerance for each condition.
2. Device boxes shall be located within 3-feet of an electrical receptacle. Where conditions are such that this is not possible, promptly notify the Engineer and await the Engineer's direction prior to rough-in of the device box.
3. For acoustical purposes, device boxes on opposite sides of a wall shall not be located back-to-back.

- C. Pull Boxes: Install pull boxes in an exposed location, readily accessible both at time of construction and after building occupation. Pull boxes shall not be installed in interstitial or otherwise non-accessible building spaces.
 - 1. If mounting pull box on ceiling structure above ceiling grid, do not mount higher than 4 feet above grid (mount on wall instead).
 - 2. Install pull boxes such that conduit enters and exits at opposite ends of the box. Conduit shall not enter pull boxes on the sides of the box (i.e. only 2 sides – at opposite ends – of the pull box may be used for conduit entry).
 - a. A pull box may not be substituted for a 90 degree bend.
 - 3. For conduit runs exceeding more than 100 feet in length, provide pull boxes so that no conduit segment between end points/pull boxes exceeds 100 feet.
 - 4. For conduit runs which require more than two 90 degree bends, install pull boxes so that no conduit segment between end points/pull boxes contains more than two 90 degree bends.
 - 5. Do not exceed one pull box per total conduit run between device box and termination point in a communications closet, unless otherwise shown on the Drawings, or approved by the Engineer.
- D. Floor Boxes: Set device boxes plumb, level, square and flush with floor. Do not exceed more than 1/16-inch tolerance for each condition. For floor boxes with combined power and communications circuits, install metal dividers for separation of circuits.

3.4 RACEWAY

- A. Sleeves: Provide sleeves where required for cable pass-through through building structures and/or fire rated barriers.
 - 1. For sleeves constructed of conduit, seal between sleeve and building structure and/or barrier. Install insulated throat bushings before cable is installed.
 - 2. For sleeves consisting of an enclosed (non-conduit) fire rated pathway device: Install sleeves per manufacturer's recommendations.
- B. Cable Supports (J-Hooks, Straps):
 - 1. Cable supports shall be used to support cables in open access environments. Supports shall be provided along the entire pathway. Multiple supports at hanger locations shall be provided as required by the quantity of cable to be supported (subject to the maximum load which can be supported by the hanger) as well as cable segregation requirements (see below).
 - 2. Cable supports may be affixed to structural members and/or other supports, but shall not be attached to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system. Supports shall be hung from all thread rods, dedicated #8 galvanized ceiling drop wire, or from brackets connected directly to structure, and shall be installed above accessible ceilings.

3. Where cable pathways are shown on the Drawings, the Contractor shall follow the indicated pathways as closely as possible, subject to field conditions. Pathways for smaller cable counts shall be designed and documented on the As-Built drawings maintained by the Contractor. Supports shall be installed parallel and perpendicular to building lines.
 4. Cable supports shall be mounted at varying intervals with each interval not to exceed 5 feet. Supports shall also be placed at all changes of direction. The Contractor shall ensure that intervals between cable supports shall vary along the pathway (i.e., a given interval should not be exactly the same length as the interval preceding or following it - "exact" intervals can degrade cable performance).
 5. Cable supports shall not support more cables than for which they were designed and shall not exceed 50% of the manufacturer's recommended fill. Multiple cable supports shall be provided where the total cable fill exceeds this amount.
 6. Installation of supports shall be fully coordinated with other elements such as mechanical ductwork, piping/plumbing, electrical conduit, and other systems such that the supports remain fully accessible after installation.
- C. Cable Tray: Cable Tray (Welded Wire Cable Tray) shall be installed in the locations shown on the Drawings and as follows:
1. Cable tray shall be installed in accordance with recognized industry practices (NEMA VE2 2000) to ensure that the cable tray complies with the requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
 2. Cable tray installed for communications circuit distribution may not be used for distributing electrical power. Cable tray installed for communications circuit distribution may not be used for distributing other signals without prior approval from the Engineer.
 3. Prior to installation, examine areas to receive cable tray. Notify the Engineer/Owner of conditions that may adversely affect the installation, subsequent use, or cause the tray (or circuits to be subsequently installed in the tray) to not comply with ANSI/TIA standards.
 4. Coordinate layout and installation of cable tray with other construction elements and trades to ensure adequate headroom, working clearance and access.
 5. Install cable tray level and plumb in accordance with the manufacturer's recommendations, coordination drawings, original design, and referenced standards.
 6. Install expansion connectors where cable tray crosses a building expansion joint. Space connectors and set gaps per NEMA VE-2 2000.
 7. Route cable tray as follows:
 - a. Maintain a minimum clearance of 12 inches between top of cable tray and other elements such as ceiling structure, ducts, equipment, and other raceways. Where this is not possible, for very short distances (3 feet or less), a minimum clearance of 3 inches is acceptable. For longer

- distances, Contractor shall obtain the approval of the Engineer prior to installation.
- b. Maintain a clearance of 6 inches between bottom of cable tray and ceiling grid or other equipment or raceway.
 - c. Maintain a clearance of 4 feet from motors or transformers.
 - d. Maintain a clearance of 1 foot from conduit or cables used for electrical power distribution.
 - e. Maintain a clearance of 18 inches from fluorescent lighting.
 - f. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits wherever possible.
8. Bends shall be long radius and shall ensure that the cable bend radius requirements called for in the ANSI/TIA standards can be met. Short radius bends and abrupt Tsections shall not be used unless specifically called out on the Drawings.
 9. Seismic bracing: Brace cable tray to structure with diagonal braces spaced a maximum 30 feet on center or as is required per local codes.
 10. Cable tray supports shall be attached to the structural ceiling or walls with hardware or other installation and support aids specifically designed for the cable tray and designed to support the cable tray's weight and required cable weight and volume.
 - a. Do not attach cable tray supports to ceiling support system or other mechanical support systems.
 - b. Load span criteria: Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections for maximum load (based upon length, depth, and span). Install fitting supports per NEMA VE-2 guidelines, and in accordance with manufacturer's instructions
 11. Only dual supports are acceptable.
 12. Wall supports may not be used as the only means of cable tray support but may be used in combination with an outer trapeze support from structure.
 13. Connections: Tighten electrical connectors and joints according to manufacturer's recommended torque-tightening values. Where such values are not indicated by the manufacturer, use those specified in UL 486A and 486B.
 14. Cable tray shall be cut with a manufacturer approved bolt cutter with "offset cutting blade" jaws and a minimum 24 inch handle.
 - a. The choice and position of the jaws at the point where the cut is to be made shall allow shearing as close as possible to the intersection of the steel wires. Cuts shall ensure integrity of galvanic protective layer.
 15. Cable tray shall be installed without burrs, sharp edges, or projections that may damage cable insulation. After installation, repair any damaged finishes. Repair damage to galvanized finishes with zinc-rich paint per the manufacturer's recommendations.
 16. Vertical Transitions (Elevation Changes): Contractor shall provide and install all vertical transitions as required by actual field conditions.

17. Testing: Test cable tray support system according to NFPA 70B, Chapter 18 to ensure electrical continuity of grounding and bonding connections (see Grounding and Bonding below) and to demonstrate compliance with specified maximum grounding resistance.

3.5 FIRESTOPPING

- A. Installation of firestops shall be in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and the applicable portions of the Governing Requirements (see 270100 – Communications General Requirements, Part 1 - General: References and Standards). Application of sealing material shall be accomplished in a manner acceptable to the local fire and building authorities.
- B. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
 1. Prepare surfaces per manufacturer's instructions. After installation, clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling.
 2. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.
Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 3. Protect materials from damage on surfaces subjected to traffic.
 4. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.
 5. Where joint application is exposed to the elements, fire resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.
- C. Penetrations through and membrane penetrations of fire rated barriers shall be firestopped and sealed. The fire rating of all penetrated fire barriers shall be strictly maintained.
- D. Install firestopping in open penetrations and in the annular space of penetrations for fire rated barriers.
- E. Do not install firestop products when ambient or substrate temperatures are outside limitations recommended by the manufacturer.
- F. Do not install firestop products when substrates are wet due to rain, frost, condensation or other causes.
- G. Do not use materials that contain flammable solvents or sodium silicate.
- H. Cables, conduits, and other raceway shall be firmly secured and cleaned where penetrating fire rated barriers. Firestopping devices shall not act as supports.
- I. Cable trays: Where cables in cable trays are required to maintain specific distances between each other they shall be firmly secured to maintain this distance at fire rated penetrations. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

3.6 GROUNDING AND BONDING

- A. Grounding and bonding work shall comply with the National Electrical Code, UL 467, TIA standards and the references and standards listed in Part 1 – References and Standards herein, as well as local codes which may specify additional grounding and/or bonding requirements.
- B. Primary Bonding Busbar (PBB): Directly bond PBB to electrical service ground and to associated TBBs. Group protector, busbar bonding, and approved building grounding conductors toward the left, leaving space for equipment grounding conductors to the right.
- C. Secondary Bonding Busbar (SBB) Directly bond SBB to its associated TBB and to close building structural steel or other permanent metallic systems. Group protector, busbar bonding, and approved building grounding conductors toward the left, leaving space for equipment grounding conductors to the right.
- D. Telecommunications Bonding Backbone (TBB): TBBs shall be used to connect the PBB to each SBB. Route along the shortest and straightest path possible with minimal bends. Bends shall be sweeping. TBB's shall be continuous (without splices), and shall be insulated from their support.
- E. Backbone Bonding Conductor (BBC) BBCs shall be used to bond TBBs together in multi-story buildings. BBCs shall bond TBBs together on the top floor of the building, and at a minimum of every third floor in between the top floor and the first floor. Route along the shortest and straightest path possible with minimal bends. Bends shall be sweeping. BBCs shall be continuous (without splices), and shall be insulated from their support.
- F. Bonding Conductor (BC): BCs shall be used to bond all non-current carrying metal telecommunications equipment and materials to the nearest SBB. They shall also be used to bond the grounding busbar of a panelboard serving the room containing the SBB to the SBB. Route along the shortest and straightest path possible with minimal bends. Bends shall be sweeping. BCs shall be continuous (without splices), and shall be insulated from their support.
 - 1. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.
- G. Cable Tray: Provide a #6 bare ground cable the length of the cable tray. Bond to every tray section using clamps manufactured for that purpose. Ground cable shall be located on the outside of the cable tray.

3.7 IDENTIFICATION AND ADMINISTRATION

- A. Conduits: Label each conduit end in a clear manner by designating, at each end of the conduit, the location of the far end of the conduit (i.e. room name, communications closet name, pull box identifier, cable tray, station identifier, etc.). Indicate conduit length on the label.
- B. Pull Strings: Label each pull string in a clear manner by designating, at each end of the pull string, the location of the far end of the pull string (i.e. room name, communications closet name, pull box identifier, cable tray, station identifier, etc. Indicate pull string length on the label.
- C. Pull Boxes: Label each pull box with a unique identifier. Identifiers shall be of the form "RNY" where "RN" is the room name of the room closest to (or containing)

the pull box, and "YY" is the sequential number of the pull box for each "RN." For example, the second pull box in the vicinity of room 201 would have the label "201-02."

- D. Cable Tray: Clearly mark all cable tray that is used as an equipment grounding conductor as

END OF SECTION

SECTION 27 10 00
COMMUNICATIONS CABLING

PART 1: GENERAL

1.1 SUMMARY

- A. This Section includes general requirements specifically applicable to FMOLHS ITS Network Telecommunications Infrastructure Division 16740.
- B. Work Specifically Excluded from Project:
 - 1. Incoming common carrier services.
 - 2. Private Branch Exchange Systems.
 - 3. Wide Area Network Systems.
 - 4. Materials provided by the owner as identified in the Contract Documents.
- C. The Cabling Contractor shall be responsible for:
 - 1. Providing all additional materials, and the necessary labor and services required to ensure all components of the system are completely installed in accordance with the intent of the Contract Documents.
 - 2. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
 - 3. Coordinating the details of facility equipment and construction for all specification divisions that affect the work covered under this Division.
 - 4. Coordinating all activities with the overall construction schedule.
 - 5. Developing bill of materials, performing material management and efficiently using the materials whether they are issued by the General Contractor, the owner or purchased by the Cabling Contractor.
 - 6. Ensure materials in excess of those required to complete the project are kept in their original condition and packaging for restocking.
 - 7. Ensure project is properly registered with Berk-Tek and Hubbell Premise Wiring for warranty.
- D. Intent of Drawings:
 - 1. Communications plan drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc. All dimensioned locations and elevations are approximate. The Cabling Contractor is responsible for the field coordination of communications work with the other trades prior to beginning work.
 - 2. The Cabling Contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, cable tray, and related components; according to the Contract Documents and subject to prior review by the General Contractor.

3. Refer all conflicts between Contract Documents to Contractor for resolution.

1.2 RELATED DOCUMENTS

- A. Section 260500 – Common Work Results for Electrical

1.3 REFERENCES

- A. All work shall be performed in accordance with the following Codes and Industry Standards, unless noted otherwise:
 1. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.
 2. TIA/EIA 568-B – Commercial Building Telecommunications Cabling Standard, current version.
 3. TIA/EIA 569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
 4. TIA/EIA 606-A – Administration Standard for Commercial Telecommunications Infrastructure, current version.
 5. J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.
 6. IEEE 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings, pertaining to communication systems.

1.4 DEFINITIONS

- A. Active Equipment: Electronic equipment used to develop various WAN and LAN services.
- B. Backbone: A cable or conductors and its pathway between any of the following: telecommunications rooms, telecommunications enclosures, common telecommunications rooms, floor-serving terminals, entrance facilities, equipment rooms, and common equipment rooms.
- C. Bonding: Permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.
- D. Building Equipment Room (BER): Room in each building used to distribute communications services to Telecommunications Rooms (TR) in the same building. Typically, the BER contains passive equipment used for electrical protection (protectors) and building cross-connect, and active network equipment used for LANs. The BER may also serve the function of a TR.
- E. Cabinet: Freestanding, floor-mounted, modular enclosure designed to house and protects rack-mounted electronic equipment.
- F. Cable Tray: Vertical or horizontal open supports usually made of aluminum or steel that is fastened to a building ceiling or wall. Cables are laid in and fastened to the trays. A cable tray is not a raceway.

- G. Campus: Grounds and buildings of a multi-building premises environment.
- H. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; may include one or more links, cross-connect jumper and/or patch cords, and work area station cords. Does not include connection to active equipment.
- I. Communications Equipment Room –See Telecommunications Room (TR)
- J. Cross-Connect: Equipment used to terminate and tie together communications circuits.
- K. Cross-Connect Jumper: A cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
- L. Fiber Optic Distribution Unit (FDU): Cabinet with terminating equipment used to develop fiber optic cross-connect facilities.
- M. Grounding: A conducting connection to earth, or to some conducting body that serves in place of earth.
- N. Hinged Cover Enclosure: Wall-mounted box with a hinged cover that is used to house and protect electrical devices.
- O. Horizontal: Pathway facilities and media connecting Telecommunications Rooms (TR) to Telecommunications Outlets (TO).
- P. Jack: Receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
- Q. Link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables; one continuous section of conductors or fiber, including the connecting hardware at each end.
- R. Local Area Network (LAN): Data transmission facility connecting a number of communicating devices, e.g., serial data, Ethernet, token ring, etc. Typically, the network is limited to a single site.
- S. Main Equipment Room (MER): The room used to distribute communication services to all Building Equipment Rooms (BER's) on the premises, and to interconnect premises services with the telephone companies. Typically, the MER contains passive equipment used for electrical protection (protectors) and main campus cross-connect, and active equipment used for PBX, WAN, and LAN.
- T. Media: Twisted-pair, coaxial, and fiber optic cable or cables used to provide signal transmission paths.
- U. Mounting Frame: Rectangular steel framework which can be a free standing equipment rack or wall mounted rack to support wiring blocks, patch panels, and other communications equipment.

- V. Passive Equipment: Non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, wiring blocks, fiber optic termination hardware, etc.
- W. Patch Cords: A length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross-connect.
- X. Patch Panel: System of terminal blocks or connectors used with patch cords that facilitate administration of cross-connect fields.
- Y. Pathway: Facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, underfloor systems, raised floor, ceiling support wires, etc.
- Z. Private Branch Exchange (PBX): Private communications switching system located on the user's premises. A PBX switches voice and data calls within a building or premises and between the premises and facilities provided by public common carrier networks.
- AA. Protectors: Electrical protection devices used to limit foreign voltages on metallic communications circuits.
- BB. Raceway: An enclosed channel designed expressly for holding wires or cables; may be of metal or insulating material. The term includes conduit, tubing, wireway, underfloor raceway, and surface raceway; does not include cable tray.
- CC. Racks: An open, freestanding, floor-mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.
- DD. Rack Unit (RU): A unit of measure of vertical space in an equipment rack. One rack unit is equal to 45 mm (1.75 in).
- EE. Telecommunication Outlet (TO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.
- FF. Telecommunications Room (TR): Distributes communications services to users within a serving zone and interconnects with the BER. Typically, the TER contains passive equipment used for cross-connect and active network equipment used for LANs. TR is sometimes referred to as the communications equipment room.
- GG. Wide Area Network (WAN): A data communications system that uses telecommunications circuits to link LAN's that are distributed over large geographic distances.
- HH. Wiring Block: Punch down terminating equipment used to develop twisted-pair cross-connect facilities.

1.5 SYSTEM DESCRIPTION

- A. The owner will implement a comprehensive integrated communications distribution system, as described in paragraph B below, to provide wiring infrastructure which may be used to support one or more of the following services and systems:
 1. Data telecommunications.
 2. Wireless systems.
 3. Facilities management systems.
- B. The communications distribution system consists of the following major subsystems, as specified elsewhere:
 1. Interbuilding Backbone: The interbuilding subsystem refers to all twisted-pair and fiber optic backbone communications cabling connecting the Main Equipment Room (MER) to each building equipment room (BER) in all buildings on the campus. Note: typically outside plant cables.
 2. Intrabuilding Backbone: The intrabuilding subsystem refers to all twisted-pair and fiber optic backbone communications cabling connecting the Building Equipment Room (BER) to each Telecommunication Room (TR) in the buildings.
 3. Communication Rooms: The communications room contains the distribution subsystem comprised of the passive components used to terminate cabling subsystems and distribute communications services. This subsystem includes installations in the Main Equipment Room (MER), Building Equipment Rooms (BERs), Telecommunications Rooms (TRs) and Telecommunications Enclosures (TEs).
 4. Horizontal Distribution: The horizontal distribution subsystem refers to all intra-building twisted-pair and fiber optic communications cabling connecting telecommunication rooms (TRs) to telecommunication outlets (TOs) located at individual work areas.
 5. Work Area Distribution Subsystem: Patch cords, adapters, and devices located between the TO and station equipment.
- C. The communications distribution system is based on a combination of the following communications transmission technologies:
 1. 100-ohm 4-pair unshielded twisted-pair cable (Cat 6a)
 2. 100-ohm multi-pair unshielded twisted-pair cable (Cat 3)
 3. 50/125 micron laser optimized multimode fiber optic cable
 4. 62.5/125 micron multimode fiber optic cable
 5. 8.3/125-micron singlemode fiber optic cable
 6. 8-position telecommunications jacks
 7. 8-position telecommunications patch panels
 8. Insulation displacement connector (IDC) type field terminated wiring blocks

9. Factory Terminated copper patch cords
 10. Rack mount fiber optic hardware
 11. Wall mounted fiber optic hardware
 12. Fiber optic connectors.
 13. Factory terminated fiber optic patch cords
- D. The work locations and limits of work are shown on the drawings.

1.6 SUBMITTALS

- A. General:
1. Provide ongoing inspection and permit certificates and certificates of final inspection and acceptance from the authority having jurisdiction.
 2. Manufacturer's standardized schematic diagrams and catalog cuts shall not be acceptable unless applicable portions of it are clearly indicated and non-applicable portions clearly deleted or crossed out.
 3. When the specifications include product descriptions, model numbers, part numbers, etc. that have been superseded, changed, or discontinued, the Contractor shall submit a comparable substitution for review by FMOLHS ITS Network and the A/E.
 4. Hubbell Premise's Mission Critical certificate stating that the Cabling Contractor is in good standing with the Hubbell Premise Mission Critical certified installer program.
- B. Provide all applicable portions of the following information with the Bid:
1. Documentation establishing qualifications to perform installation functions as required in 1.6.
 2. Statement demonstrating an understanding of project scope and schedule which includes the following information:
 - a. Where (city, office) the project will be staffed.
 - b. Project organizational chart with team member names; e.g., project manager, principal skilled technicians, and contractors.
- C. Provide all applicable portions of the following information within 10 days after award of Subcontract:
1. Project schedule in hard copy. Include, at a minimum, major tasks, milestones, dependencies, staffing, and durations for each task.
 2. Contractor shall then work with the General Contractor to merge this schedule into the overall construction schedule.
 3. Provide the following information for materials, components, and equipment to be furnished by the Contractor:
 - a. Descriptive literature, manufacturer's specification data sheets, and manuals.
 - b. Manufacturer's product test data with indicator arrows.

- c. Final Performance testing criteria and data for communications distribution system cabling systems.

1.7 QUALIFICATIONS

- A. Communications Pathway Installation: The Contractor shall have 5 years of documented experience installing raceway and cable tray systems for each of the types and system material components specified in the Contract Documents, e.g., underground duct banks, cable tray, etc. In the case of newer technologies that do not have a 3-year history, the Contractor shall have documented experience for at least half of the lifetime of the new technology.
- B. The Contractor selected for this project must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this project.
- C. The Cabling Contractor must be a fully approved Hubbell Premise Mission Critical certified installer.
- D. The Cabling Contractor is responsible for workmanship and installation practices in accordance with the Hubbell Premise Mission Critical program. The certified Contractor shall have 30% of their technicians trained on copper installations and testing by Hubbell.
- E. Company certificate & letter from manufacturer stating certification is in good standing, shall be included with submittal.
- F. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Cabling Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical fiber, Category 6 and Category 6a premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

1.8 QUALITY ASSURANCE

- A. All work and equipment shall conform to the appropriate portions of the following specifications, codes and regulations
 - 1. Building Industry Consulting Services International (BICSI)
 - 2. Telecommunications Distribution Methods Manual
 - 3. ANSI/TIA/EIA Standards
 - a. ANSI/TIA/EIA-568-B.1- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - b. ANSI/TIA/EIA -568-B.2 - Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.

- c. ANSI/TIA/EIA – 568-B.3 - Optical Fiber Cabling Components standard
 - d. ANSI/TIA/EIA - 569A- Commercial Building Standard for Telecommunications Pathways and Spaces
 - e. ANSI/TIA/EIA – 606 (A) - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - f. ANSI/TIA/EIA - 607 (A) - Commercial Building Grounding and Bonding Requirements for Telecommunications
 - g. ANSI/TIA/EIA - 526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
 - h. ANSI/TIA/EIA-526-14A - Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant.
 - i. ANSI/TIA/EIA-758(A) - Customer-Owned Outside Plant Telecommunications Cabling Standard.
- 4. National Electric Safety Code (NESC)
 - 5. National Fire Protection Agency (NFPA)
 - 6. National Electrical Code (NEC)
 - 7. Any Applicable State and Local Codes

1.9 REFERENCES

- A. All work shall be performed in accordance with the following Codes and industry Standards, unless noted otherwise:
 - 1. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.
 - 2. TIA/EIA 526 – Standard Test Procedures for Fiber Optic Systems
 - 3. TIA/EIA 568-B – Commercial Building Telecommunications Cabling Standard, current version.
 - 4. TIA/EIA 569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
 - 5. TIA/EIA 606-A – Administration Standard for Commercial Telecommunications Infrastructure, current version.
 - 6. J-STD-607-A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.
 - 7. IEEE 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings, pertaining to communication systems.

1.10 SCHEDULING

- A. The Cabling Contractor will coordinate all work with the Owner's point of contact, which will be assigned by FMOLHS ITS Network.

1.11 WARRANTY

- A. The Cabling Contractor must be a fully approved Hubbell Mission Critical certified installer. The Cabling Contractor is responsible for workmanship and installation practices in accordance with the Hubbell Mission Critical certified installer Program. The Cabling Contractor shall have 30% of their technicians trained on copper installations and testing by Hubbell Premise. Hubbell Premise will extend the Mission Critical 25-year Static, Dynamic and Applications warranty to the owner.
 - 1. Note: The Mission Critical warranty requires that the channel be completed with a qualified Mission Critical warranty partner.
- B. The Cabling Contractor shall provide labor, materials and documentation according to Hubbell Premise requirements necessary to insure that the Owner will be furnished with the Hubbell Mission Critical 25 year warranty.
- C. All necessary documentation for warranty registration will be furnished by the Cabling Contractor immediately following 100% testing of all cables and must be provided to Hubbell Premise. All test results shall be submitted in the certification tester's original software on CD.
- D. Cabling Contractor shall administer the warranty process with the responsible manufacturer's representative. The warranty shall be provided directly to the owner from the manufacturer. The Cabling Contractor shall insure that the manufacturer provides the Owner with the appropriate warranty certification within 30 calendar days of the final project completion.
- E. Transfer any additional manufacturer's warranties to the owner in addition to the above-mentioned warranties. Submit these warranties on each item in list form with any applicable shop drawings. Detail specific parts within equipment that are subject to a separate conditional warranty or warranties.
- F. In addition to the standard warranty requirements, the Cabling Contractor shall provide the following during the warranty period:
 - 1. Within 24 hours after notification of a defect, the Cabling Contractor shall start to make the necessary corrections and inform the appropriate Project Manager of the planned corrective actions. The Cabling Contractor shall follow this initial contact with continuous effort and complete any required corrective work within 15 days after notification.

PART 2 - PRODUCTS

1.12 MANUFACTURERS

- A. Acceptable manufacturers:
 - 1. Berk-Tek - Copper Network Cable Products
 - 2. Hubbell Premise – Network Connectivity Products
 - 3. Corning Cabling Systems – Fiber Optic Products

- B. All products shall be "NEW"
- C. Non-compliant products installed as a part of this Contract shall be removed and replaced. All costs for removal and replacement shall be borne solely by the Contractor(s).

1.13 STATION CABLING

- A. Category 6 - Unshielded Twisted Pair Cable – Network Communications
 - 1. Without exception, all Category 6 network cabling shall be YELLOW.
 - 2. Network cabling shall be compliant with ANSI/TIA/EIA-568-B.2-1 and ETL verified for performance.
 - 3. Cable construction shall be four unshielded twisted pair, 23 AWG, insulated with polyethylene (non-plenum, CMR) or insulated with FEP (plenum, CMP).
 - 4. Berk-Tek LANMARK 10G-2 part numbers:
 - a. CMR - 10137706
 - b. CMP – 10137385

1.14 WORK AREA OUTLETS

- A. Category 6 – Modular Jacks – Network Communications
 - 1. Without exception, all network jacks shall be ORANGE.
 - 2. 8-position modular jack, Category 6, IDC terminals, T568A/B wiring scheme.
 - 3. Each jack must be stamped or have icons to identify it as CAT 6.
 - 4. Hubbell Part Number:
 - a. Category 6 - HJA6OR
- B. Face Plates – Flush Mount
 - 1. Without exception, all flush mount face plates shall be OFFICE WHITE.
 - 2. Face plates must have ANSI/TIA/EIA-606-A station labeling capability.
 - 3. Hubbell Part Numbers:
 - a. Single-gang – IFP1xOW
 - b. Stainless Steel Single-Gang – SSF1x
 - 1) NOTE: x designates the number of ports
- C. Work Area Outlets - Surface Mount

1. Without exception, all surface mount work area outlets finishes shall be confirmed with architect.
2. Surface mount work area outlets must have ANSI/TIA/EIA-606-A station labeling capability.
3. Hubbell Part Numbers:
 - a. Single port – ISM10*
 - b. Two port – ISM20*

1.15 PATCH CORDS AND JUMPERS

- A. Category 6 - Unshielded Twisted Pair Patch Cords – Voice & Network Communications
 1. Without exception, all patch cords shall be Category 6A, YELLOW
 2. Patch Cords shall be compliant with ANSI/TIA/EIA-568-B.2-1 and ETL verified for performance.
 3. Patch Cord construction shall be four unshielded twisted pair, stranded 24 AWG, with snagless boots, wired T568B.
 4. Allen Tel part numbers:
 - a. Yellow – ATG10xx-xx
 - 1) NOTE: xx designates length in feet and color
- B. Fiber Optic Jumpers
 1. Fiber Optic Jumpers shall be factory terminated, constructed with an aramid-reinforced PVC loose-tube duplex zip-cable, with optical fibers having a 900-micron PVC buffer coating.
 2. Connector terminations on each end of the fiber patch cord shall be heat-cured epoxy type with a machine polish and 100% tested for insertion loss and reflection.
 3. Fiber Optic Jumpers shall be supplied in a sealed plastic bag with dust caps installed on each end, with insertion loss test results included.
 4. Fiber Optic Jumpers shall be available in standard lengths of 1, 2, 3, and 5 meters. Special lengths shall be available on a make-to-order basis.
 5. Factory mounted connectors on each end of the patch cords shall comply with the applicable ANSI/TIA/EIA-604 FOCIS intermateability standard.
 6. Allen Tel or Equal Part Numbers:
 - a. GBxxx-xx-xx

1.16 PATCH PANELS

- A. Category 6 – Patch Panels – Network Communications

1. Category 6A, 96 ports, 8-position RJ45 Patch Panel, with industry standard 110 IDC terminals, T568A/B wiring scheme.
2. Network Patch Panels shall be compliant with ANSI/TIA/EIA-568-B.2-1.
3. Panels shall provide space above the ports for labeling per ANSI/TIA/EIA-606-A and shall include self-adhesive, clear label holders for each row of 24 ports.
4. Hubbell Part Number:
 - a. Category 6, 48 Port Patch Panel- UDX48E
 - b. Category 6, 48 Port Patch Panel- UDX4996E

1.17 FIBER OPTIC CABLING

A. Laser Optimized Multimode Intra-building Fiber

1. 50 µm core, 900 µm TBII buffered fibers, all dielectric construction
2. Transmission Performance Characteristics as follows.

Wavelength	850 nm	1300 nm
Maximum attenuation (db/km)	3.0	1.0
Minimum LED Bandwidth (MHz•km)	1500	500
Minimum Effective Modal Bandwidth (MHz•km)	2000	-
Serial Gigabit Ethernet Distance (m)	1000	600
Serial 10 Gigabit Ethernet Distance (m)	300	

3. Corning Cabling Systems Part Numbers:

a. CMR

12 - 24 fibers	xxx-T81-33180-24
36 - 48 fibers	xxx-T81-61180-24
60 - 144 fibers	xxx-T81-T3180-24

b. CMP

12 - 24 fibers	xxx-T88-33180-29
36 - 48 fibers	xxx-T88-61180-29

60 – 144 fibers xxx-T88-T3180-29

B. Singlemode Intra-building Fiber

1. 8 µm to 9 µm core, 900 µm TBII buffered fibers, all dielectric construction
2. Transmission Performance Characteristics as follows:

Wavelength	1310nm	1550nm
Maximum attenuation (db/km)	0.65	0.5
Serial Gigabit Ethernet Distance (m)	5000	-
Serial 10 Gigabit Ethernet Distance (m)	10000	40000

3. Corning Cabling Systems Part Numbers:

a. CMR

12 - 24 fibers xxx-E81-33131-24
 36 – 48 fibers xxx-E81-61131-24
 60 – 144 fibers xxx-E81-T3131-24

b. CMP

12 - 24 fibers xxx-E88-33131-29
 36 – 48 fibers xxx-E88-61131-29
 60 – 144 fibers xxx-E88-T3131-29

1) NOTE: xxx designates the fiber count

1.18 FREE STANDING EQUIPMENT RACKS

- A. 45 RMU, 7 feet high, 19 inches wide, 3 inch channel depth, EIA free-standing rack, 1000 lb capacity, UL listed, black finish

1. Chatsworth – 55053-703

1.19 CABLE MANAGEMENT

- A. Horizontal cable management shall accompany all patch panels. For each 96 port patch panel installed, 2 single sided horizontal managers shall be

installed. One will be installed above the patch panel to accommodate the upper 48 ports and the second will be installed below the patch panel to accommodate the lower 48 ports.

1. 1 RMU, 19 inches wide, 4.96 inches deep, single sided, rack mountable, black powder coat textured finish, contoured cable guide fingers spaced 1.75 inches apart with snap-on covers.

- a. Chatsworth Part Number:

- 1) 30139-719

- B. Vertical cable Management shall be installed on all free standing racks. Each rack shall have 2 vertical cable managers with both front and rear channels. The rear channel will be an open channel for easy access and routing of cables. The front will have 1 RMU cable guides with swing doors.

1. 7' high, 14.61" deep, 6" wide, double sided with doors on the front, black powder coat finish.

- a. Chatsworth – 30165-703 (END OF RACKS)

2. 7' high, 14.61" deep, 10" wide, double sided with doors on the front, black powder coat finish.

- b. Chatsworth – 30166-703 (BETWEEN RACKS)

1.20 RACEWAY TO RACK AND WALL MOUNTING

- A. Secures cable raceway up to 12 inches wide to the top of a standard freestanding equipment rack and cable raceway to the wall. Mounting hardware included.

1. Chatsworth – 11911-712

1.21 FIBER OPTIC RACK HARDWARE

- A. Housings shall be available in both 1U, 2U and 4U sizes. Housings shall be manufactured using 16-gauge aluminum or equivalent for structural integrity and shall be finished with a rustic gun-metal grey powder coat for durability. The front and rear doors shall be lockable when used with an optional key lock kit. The housing shall have the ability to accomodate fusion splicing with additional hardware.

- B. The cable clamp shall accept one cable from 9.5 to 28.6 mm in diameter. The cable clamp mechanism shall also handle multiple smaller fiber count cables when used with the multiple cable insert. The total cable capacity per clamp shall be five cables (≤ 10.2 mm OD) when used with the multiple cable insert.

Housing	Dimensions	Fiber Capacity LC Connectors
	H x W x D (in)	
PCH-01U	1.75 x 17 x 16	48
PCH-02U	3.5 x 17 x 16.5	96
PCH-04U	7 x 17 x 16	288

1.22 FIBER OPTIC PATCH PANELS

- A. The Closet Connector Housing Panels shall be offered in 6-, 8-, 12-, 16- and 24-fiber versions for use with the LANscape® Solutions hardware products. The panels shall be able to be used with field-installable connectors or in applications where the preconnectorized cables are routed directly from the equipment to the interconnect hardware
- B. The Closet Connector Housing Panels shall be designed to accommodate applications requiring specified labeling and connector identification. This shall be accomplished by the use of colored snap-in icons with different symbols molded into the icon.
- C. The 6-fiber panels shall be offered in LC duplex. The 8- and 12-fiber versions shall include LC duplex. For high-density applications, the LC panels shall be available in 16- and 24-fiber versions

Patch Panels	Dimensions	Fiber Count
	H x W x D (in)	
CCH-CP12-E4	LC 50um Laser Optimized	12
CCH-CP24-E4	LC 50um Laser Optimized	24
CCH-CP12-A9	LC Single Mode	12
CCH-CP24-A9	LC Single Mode	24

1.23 FIBER OPTIC CONNECTORS

- A. The connector installation shall not require the use of epoxies, adhesives or ovens. The connector shall be installable upon 900 µm buffered fiber in one minute or less. The connector shall contain a mechanical splice and require one tool kit to assemble. The installation tools used to terminate the connector shall be able to terminate other small form factor and single-fiber

UniCam® connector designs. The connector shall not require end face polishing in the field.

Connector	Type
95-050-99-X	LC 50um Laser Optimized
95-200-99	LC Single Mode

PART 3 - EXECUTION

2.1 GENERAL

- A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.
- B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.
- C. All work shall comply with the standards, references and codes listed in PART 1 – REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.
- D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.
- E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.
- F. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.
- G. Remove surplus material and debris from the job site and dispose of legally.

2.2 UNSHIELDED TWISTED PAIR CABLE INSTALLATION PRACTICES

- A. Cable shall be installed in accordance with manufacturer recommendations and best industry practices.
- B. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

- C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- D. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
 - 1. Bend radius for UTP = 4 times the cable OD.
 - 2. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf.
- E. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
 - 1. Open or Nonmetal Communications Pathways:
 - a. 12 inches from electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA.
 - b. 36 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - c. 48 inches from large electrical motors or transformers.
 - 2. Grounded Metal Conduit Communications Pathways:
 - a. 2 1/2 inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - b. 6 inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - c. 12 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - d. 3 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - e. 6 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

2.3 UNSHIELDED TWISTED PAIR TERMINATION

- A. Cables shall be coiled to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored; Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations and best industry practices.

- C. All 4 pair cables shall be terminated on the jack and patch panels using T568-B or T568-A wiring scheme.
- D. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- E. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.
- F. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- G. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

2.4 UNSHIELDED TWISTED PAIR TESTING PROCEDURES

- A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including but not limited to, cable, connectors, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the OASIS and Mission Critical procedures and best industry practice. If any of these are in conflict, the Cabling Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
- C. Cables, jacks, connecting blocks, and patch panels shall be in their final position with the building energized.
- D. All Unshielded Twisted Pair cables shall be tested as follows:
 - 1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Fluke Networks or similar certification tester for category 6, and category 5e performance compliance as specified in ANSI/TIA/EIA-568-B.2-1
 - 2. Follow the Standards requirements established in ANSI/TIA/EIA-568-B .1, B.2-1.
 - 3. Testing shall be accomplished with a UL verified tester, which meets ISO Level IV and proposed TIA Level IIIe Accuracy requirements.
 - 4. The basic tests required are:
 - a. Wire Map
 - b. Length (feet)

- c. Insertion Loss (dB) (Formerly Attenuation)
 - d. NEXT (Near end crosstalk) (dB)
 - e. Return Loss (dB)
 - f. ELFEXT (dB)
 - g. Propagation Delay (ns)
 - h. Delay skew (ns)
 - i. PSNEXT (Power sum near-end crosstalk loss) (dB)
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB)
 - 1) Note: Cat 6 shall be tested utilizing a Cat 6 auto test to 250 MHz. Cat 5e shall be tested utilizing a Cat 5e auto test to 100 MHz.
5. All test results shall be provided in the approved certification testers original software format on a CD, with the following minimum information per cable:
- a. Circuit ID
 - b. All information from 3.5D.4 above.
 - c. Test result, "Pass" or "Fail"
 - d. Date and Time of test
 - e. Project Name
 - f. NVP
 - g. Version of software
 - 1) Note: These results shall be retested and submitted after a PASS is received.
6. A software copy of the test results, in the original tester software format, shall be provided to the Owner and the channel components manufacturer.
7. Cabling Contractor shall provide a fully functional version of the tester software for use by the Owner in reviewing the test results.
8. Any failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs), must be reported in writing to the Owner immediately, along with a copy of the test results.

2.5 FIBER OPTIC INSTALLATION PRACTICES

- A. Fiber Optic Cable shall be installed in accordance with manufacturer recommendations and best industry practices.
- B. Fiber Optic Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- D. The fiber optic cable's minimum bend radius and maximum pulling tension shall not exceed the manufacturers recommendations.
 - 1. Bend radius for Fiber Optic Cable
 - a. 10 times the cable OD under no tension
 - b. 20 times the cable OD when being pulled
 - 2. Pulling tension on Fiber Optic Cable shall not exceed

Short term
(lbf) Long term (lbf)

CMR

2 – 12 fibers	148	45
24 – 144 fibers	297	89

CMP

2 – 12 fibers	99	30
24 – 144 fibers	148	45

2.6 FIBER OPTIC TEST PROCEDURES

- A. Campus and Building Backbone
 - 1. Testing shall comply with TIA-526-7. OFSTP 7 for singlemode fiber and TIA-526-14-A. OFSTP 14A for multimode fiber.
 - 2. Each fiber strand shall be tested at their two corresponding wavelengths (multimode at 850 nm and 1300 nm; singlemode at 1310 nm and 1550 nm)
 - 3. The Cabling Contractor shall provide end-to-end OLTS field tests reports for all installed and terminated optical fiber cabling. The following tests are required:

- a. Length
- b. Polarity
- c. Attenuation

1) NOTE: An OTDR trace may be substituted when the fibers at one end are to be left unterminated.

- 4. The Cabling Contractor shall provide the hard copy OTDR trace as documentation for all "as-built" fiber optic campus and building backbone.

B. Horizontal and Centralized Cabling

- 1. Testing shall comply with TIA-526-7. OFSTP 7 for singlemode fiber and TIA-526-14-A. OFSTP 14A for multimode fiber.
- 2. Each fiber strand shall be tested at their two corresponding wavelengths (multimode at 850 nm and 1300 nm; singlemode at 1310 nm and 1550 nm)
- 3. The Cabling Contractor shall provide end-to-end OLTS field tests reports for all installed and terminated optical fiber cabling. The following tests are required:
 - a. Length
 - b. Polarity
 - c. Attenuation
- 4. OTDR trace reports are not required for horizontal cabling.

2.7 EQUIPMENT ROOMS

- A. Freestanding equipment racks shall be fastened to the communications room floor using a minimum of four 3/8-inch concrete anchors.
- B. Equipment racks shall be positioned according to drawings with a minimum of 3 feet clearance in front and back. The Contractor shall field verify the dimensions of the room prior to installation of racks and report any discrepancies to the owner or owners representative.
- C. Vertical wire managers for freestanding racks shall be bolted to the side or front of the rack using the manufacturers recommended hardware.
- D. All equipment racks, cabinets, enclosures, cable tray, conduits, and patch panels shall be bonded to the Telecommunications Grounding Busbar (TMG) (one per Telecommunications Room), which shall be bonded to the Telecommunications Main Grounding Busbar (TMGB), which shall be grounded to the main electrical ground in the main electrical room. Coordinate with electrical contractor. Coordinate exact routing and connection points with the

electrical work. All surfaces that are used as a bond shall be filed to bare metal before completing connections.

- E. Install cable tray as shown in drawing package. The locations shown may need to be adjusted slightly in the field to assure proper placement.
 - 1. Note: Drawings may be in Division 26 Electrical.
- F. All tray sections shall be field cut to length as required with a minimum number of splice points.
- G. All tray shall be supported from the building structure using threaded rod and FAS type supports and shall be bonded to ground.

2.8 LABELING

- A. All horizontal cables are to be labeled using a machine printed label at each end of the cable at approximately 12 inches of the termination point, and again at approximately 48 inches from the termination point. Handwritten labels shall not be used.
- B. All patch panel ports and TO ports shall be labeled with the cable identifier.
- C. The labels shall denote the TO ID, as well as the unique cable number for that TO, i.e. A-001-A for cable number 1, A-001-B for cable number 2, and so forth. Owner may provide specific labeling requirements coordinate with owner.
- D. Note all labeling information on the as-built drawings.

END OF SECTION 270000

SECTION 27 4133

CATV DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

1.2 SUMMARY

- A. In General provide an active CATV video distribution system using a fiber cable plant, located in the TR's., and connected through RF Broadband High Definition Video Distribution Hubs and Category 6A cable to Category 6A outlets and RF Video Baluns at each TV. Match owner standards.

1.3 SYSTEM DESCRIPTION

- A. Furnish and install a complete and fully operational Television Signal Distribution System capable of delivering up to 158 video channels (6 MHz NTSC Channels containing NTSC, ATSC and QAM modulated programs) and IP Video over an installed Category 6A unshielded twisted pair cable system. The System shall utilize a cable plant comprised of a TIA/EIA 568 compliant horizontal distribution cable system and a coaxial and/or single mode fiber backbone system. The System shall employ Active Automatic Gain Control Electronics to adjust the video signal levels to each TV and shall be capable of supporting up to 14,000 connected devices. The System shall support bi-directional RF transmission for backbone interconnections. Include amplifiers, power supplies, cables, outlets, attenuators, hubs, baluns, adaptors, transceivers, and other parts necessary for the reception and distribution of the local CATV signals. Back-feed existing campus system.
- B. Distribute cable channels to TV outlets to permit simple connection of EIA standard Analog/Digital television receivers.
- C. Deliver at outlets monochrome and NTSC color television signals without introducing noticeable effect on picture and color fidelity or sound. Signal levels and performance shall meet or exceed the minimums specified in Part 76 of the FCC Rules and Regulations
- D. Provide reception quality at each outlet equal to or better than that received in the area with individual antennas. Deliver at television outlets a minimum 0 dBmv and maximum of +15 (analog equivalent) dBmv for each channel at each outlet.
- E. Meet FCC requirements regarding low radiation of RF signal.
All active components shall be of solid state design. The system shall be designed to prevent direct pickup of signals from the building structure.
- F. Design and install the system for 24 hours a day continuous operation.
- G. System shall have capability for web-based monitoring program, allowing of equipment; including power status, RF levels, port functionality and balun condition.

1.4 SUBMITTALS

- A. Provide shop drawings of complete system. Include all cabling, devices and equipment needed for the system and product data for all components.
- B. Product Data: Prepare and submit data sheets for each piece of equipment called out in the specifications for review prior to installation. If more than one product is shown on a page, clearly indicate which device is submitted for approval.
- C. Shop Drawings: Prepare and submit for review prior to installation. Include complete system plans showing device layout, routing, wiring, termination, and connection diagrams. Include signal level and loss calculations.
- D. Contract Close-out Submittals:
 - 1. The Owner shall be provided with as-built drawings, included in the O&M manuals, which shall indicate:
 - a. Actual cable types and routing.
 - b. Actual system wiring diagrams, connection diagrams, and interface of components in the system.
 - c. Levels of each tap used in system and appropriate signal level in dB of each leg off each tap.

1.5 QUALITY ASSURANCE

A. Qualifications:

- 1. Equipment shall be furnished and installed by a certified technician with proven experience in the design and installation of television distribution systems of this type.
Installer must be manufacturer Certified. (Certified once per calendar year)
- 2. Construct the system following good engineering practices and in accordance with applicable codes and safety precautions.
- 3. Periodically inspect portions of the system installed by other contractors to minimize potential interference problems.
- 4. Equipment shall be FCC Part 15 compliant.
Equipment and supports/accessories shall bear UL label. Where specified equipment is not manufactured with label, arrange on-site review and labeling conforming to those requirements at the expense.
- 5. Project manager (to be identified at time of install) will be responsible for all aspects of the video system: assuring that all cables, equipment, television signal quality and programming are provided for installation prior to system certification. Scheduling system certification will be the responsibility of the project manager.

B. Manufacturer Warranty

- 1. Warrant equipment: Intelligent Powered Baluns and Video Distribution Hubs for a one year period; (1) year from purchase date. The warranty shall conform to the standard manufacturer's backed warranty for each piece of equipment.

- a. Warranty may be changed to be activated upon install only by contacting the manufacturer to arrange specific terms.
2. Warrant against mechanical or electrical defects except when such defects are caused by misuse.

C. Maintenance

1. Maintenance Service: Maintain a fully equipped service organization capable of maintaining the installed system.

PART 2 - PRODUCTS

2.1 SUMMARY

- A. The RF High Definition Video Distribution System shall consist of user-configurable and autoconfiguring components, which facilitate simple modifications and additions to the System. The System shall support up to 14,000 outlets and allow cascading of units up to four levels deep. Passive and active electronic components of the System shall be FCC certified to operate on a Category 6 cable plant, shall be compliant with "FCC Regulations, Part 15," and shall be UL/CSA listed. Additionally, the components shall be designed with passive circuitry to allow transmission of IP voice, IP data or other low voltage signal types on the pairs of the Category 6A cable which are unused by the System.

2.2 MANUFACTURERS

- A. Z-Band Video Inc.; 848B North Hanover St.; Carlisle, PA 17013

2.3 PRODUCTS

- A. RF Broadband High Definition Video Distribution Hub in 24 Port and 12 Port configurations
 1. Provides a method of distributing up to 158 RF modulated NTSC, ATSC or QAM channels and six sub-channels (T8-T13) over Category 6 (CAT 5e, 177 channels) in a TIA/EIA 568 horizontal cabling infrastructure. The High Definition Video Distribution Hub requires a 23dBmV CATV flat NTSC signal input for optimal performance. The optimum ATSC/QAM input signal level is 17dBmV for (Digital) and 20dBmV (Digital) for cable box applications.
 2. The HD Video Distribution Hub shall be self-configuring and plug-and-play so as to easily accommodate adds, moves and changes, and maintains proper signal level and slope to all drops.
 3. The HD Video Distribution Hubs shall combine, split, amplify and equalize the signals so as to achieve a high picture quality and to be in compliance with "FCC Regulation, Part 15".
 4. The HD Video Distribution Hub shall cascade up to four levels deep in series and accommodate up to 14,000 outlets.
 5. The maximum distances between the cascaded "HD GigaBUDs" are: 400' with RG-6 coaxial cable, 600' with RG-11, and 1050' with .500 semi-flex coax. These shall reflect an attenuation budget of 12.5 dB at 240 MHz. Single mode fiber up to 25km may be used to cascade HD Video Distribution Hub

6. Category 6A cables and hardware must have the ability to transport NTSC, ATSC and or QAM signals up to 860 MHz and a distance of 100 meters.
7. All patch cords must match cable plant
HD Video Distribution Hubs to have built in fiber receiver option available

B. Intelligent/Remotely Powered High Definition RF Video Balun in free hang or wall mount style.

1. The Intelligent Powered Balun shall facilitate interactive software control via 10/100 Ethernet (without diplexer) and FSK or DOCSIS (with diplexer)
2. The Intelligent Powered Balun shall provide an F-Connector for output to a device with a NTSC/ATSC/QAM RF tuner (TV, Cable Box, PC with Tuner Card) labeled "TO TV".
3. The Intelligent Powered Balun shall provide a Modular Jack to connect to the RJ-45 outlet in the workspace labeled "TO WALL".
4. The Intelligent Powered Balun shall provide a second Modular Jack for auxiliary services such as 10/100 Ethernet labeled "TO AUX".
5. The Intelligent Powered Balun shall provide LED distance indicators. (Red-short, Yellowmedium, Orange-long, Orange Green-Extra Long)
6. Provide quantity of baluns to match quantity of TV outlets plus 15% spare.

C. Fiber

1. Standard Single Mode Fiber utilizing SC/APC interconnects with a transmitter capable of providing adequate power to transverse the distance between the head end to each building and/or closet as per fiber equipment manufacturer's recommendations.
2. Fiber Optic Media Convertors: Project shall be assigned a project specific part number, designated by the manufacturer. The fiber design will take into account the number of IDF's that will be fed via fiber. Design is determined by the following criteria:
 - a. Number of IDFs
 - b. Approximate number of channels
 - c. If return path is required from any IDF locations
 - d. Length of runs (if it is a campus wide distribution)
 - e. Future expansion capability
 - f. From this we will determine the size and number of the Fiber TX(s), the number of Fiber RX units and the attenuation values needed for the various pieces.

D. Return Path – DOCSIS / FSK

1. System supports DICSIS / FSK RF return
 - a. Intelligent powered balun with diplexer required
 - b. Second strand of coax in backbone required (bi-directional cascade)
 - c. Separate point to point fiber transmitter and receiver is needed; and dedicated single mode strand

E. System RF Characteristics

1. Input level to RF broadband high definition video distribution hub:
 - a. +23 dBmV flat NTSC (Analog)
 - b. +17 to +20 dBmV flat ATSC or QAM (Digital)
 - c. +20 dBmV flat QAM for cable box only applications
 2. Output level at RF-45 Outlet 10-100 meters in distance.
 - a. For Analog: 0 to +15 dBmV
 - b. Digital: -10 to +10 dBmV
 - c. Max Slope: 12 dB positive or negative
 3. Composite triple beat (CTB): 50 dB (134 channel loading)
 4. Composite second order (CSO): 51dB (134 channel loading)
 5. Modulation error rate (MER): greater than 32 dB
 6. Carrier to noise (C/N): greater than 43 dB
 7. When specifying the input to the Master Distribution Hub Input signal shall be 23 DBMV flat per all NTSC analogs channels; 17 DBMV flat/all ATSC OR QAM channels; 20 DBMV flat per all QAM channels when using a cable STB. Initial C/N shall be >45 DB
- a. System Power Requirements:
 - 1) HD Video Distribution Hub: 90to 264 VAC at 47 to 63 HZ at 2 AMPS
 - 2) Agile Modulator adaptor (8Vdc ½ Watt) remotely self-powered
 - 3) Intelligent Powered Balun (8Vdc, ½ Watt) remotely self-powered
 - b. Environmental
 - 1) Operating Temperature: 0 to 55C
 - 2) BTU/HR: Approx. 200

2.4 OUTLETS

- A. Provide outlets at each location shown on the plans. Mount in electrical contractor provided 4" square, 2" deep minimum flush electrical boxes as indicated on plans.
- B. Provisions shall be incorporated in the network to prevent 60 Hz AC or DC feedback into the distribution lines.
- C. Outlets shall be designed to cover a frequency range of 5 MHz to 1000 MHz. Insertion loss shall not exceed 1.0 db at any frequency within the designated frequency range for a 17dB isolation network. Outlets shall be back-matched from 5 MHZ to 1000 MHz.
- D. The minimum isolation value between any two outlets shall be 24 db.

2.5 TELEVISION RECEIVERS: PROVIDED BY THE OWNER

2.6 DISTRIBUTION DEVICES

- A. Cables

1. Drop Cable: Category 6A as specified in Section 271000 Communications Horizontal Cabling
 - a. Trunk Cable:
2. Coax Jumper Cable
 - a. F-connector to F-connector RG-59 Black / RG6
 - 1) One per TV location
 - b. Coordinate exact lengths with Owner prior to ordering.
3. Nurse Call Pillow Speaker TV Control Jumper Cable (per customer spec)
All cables to be procured by contactor and verified that necessary cables have been included in bill of materials for Television Signal Distribution system.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Broadband Distribution Hubs and fiber optic transceivers shall be rack mounted.
- B. Free hang Intelligent Powered Baluns shall be mounted to the TV or CPU with Velcro such that they are not visible.

3.2 TESTING

- A. On completion of the system installation, perform the following tests:
 1. Adjust the output signal of the headend launch amplifier and equalization to provide +23 dBmV flat NTSC at the input of the video distribution hubs +17-20dBmV for digital signal.
 2. Perform test for each IDF – random sampling at TV locations residing at short, medium and long runs. Document test results from testing as described above. Testing should be performed and documented prior to final acceptance, training and certification by manufacturer.
 3. Procure all test equipment to perform the CATV system evaluation.

3.3 SYSTEM CERTIFICATION

- A. Product manufacturer recommends project certification. During this time the manufacturer is on site - making sure the system is functioning optimally, as well as using the time to train the responsible parties on the care and feeding of the Distribution System. This is invoiced out as engineering days. The number of days required is determined by a number of factors, such as the size of the project, RF experience of the Installer and the end user, complexity of the system etc. The project manager is charged with determining that all criteria have been met prior to on-site system certification.
- B. Criteria to be met prior to on-site system certification:

1. Equipment racked
2. All cabling/fiber, including cable/fiber jumpers must be installed
3. TVs installed
4. Intelligent Powered Baluns installed at TV locations
5. CATV head end signal is functional and of sufficient quality and at acceptable signal levels

END OF SECTION

SECTION 27 5113

OVERHEAD PAGING

PART 1 - GENERAL

1.1 SUMMARY

- A. Modify and extend existing overhead paging system as required for a complete system. The system shall be a zoned overhead paging system with integration to the telephone system. Coordinate with engineer and owner for zoning.
- B. Contractor shall fully design and implement a system as required to meet the full requirements of this specification and for the field requirements of the project.

1.2 FUNCTIONAL REQUIREMENTS

- A. System shall provide zoned, one-way voice paging and background music for up to 99 zones and up to 32 paging zone groups
- B. Selectively connect any zone to any available signal channel.
- C. Selectively control sound from microphone outlets and other inputs.
- D. "All-call" feature shall connect the all-call sound signal simultaneously to zones regardless of zone or channel switch settings.
- E. Telephone paging adapter shall allow paging by dialing an extension from any telephone instrument and speaking into the telephone. The connection to the paging system is to be determined by the Owner and could be VoIP, digital, analog or some other phone connection.
- F. Produce a program-signal tone that is amplified and sounded over speakers, overriding signals currently being distributed.
- G. System shall allow background music to be inhibited in any zone
- H. System shall automatically mute the background music during a page announcement within a given zone. Other zones shall remain unaffected.

1.3 REFERENCE STANDARDS

- A. NFPA 70 – The National Electric Code
- B. EIA/TIA-607 - Telecommunications System Grounding
- C. ANSI/TIA-568-B.1, 2, and 3 – Telecommunications Cabling Standards
- D. ANSI/TIA-569-B – Telecommunications Pathways and Spaces

1.4 SUBMITTALS

A. Action Submittals

- 1. Product Data Sheets – Submit manufacturers data sheets on the system components including but not limited to, electrical specifications, mechanical specifications, rough-in and installation instructions, and operation and maintenance instructions.
- 2. Shop Drawings

- a. Functional Block Diagram – Provide an overall block diagram showing all interconnections between components. Every device shall be identified and every required port shown. Block diagrams or system-generated documentation shall indicate the system configuration and system default settings or conditions.
 - b. Network Drawing – Provide a system network riser diagram showing the network hierarchy, including all switches and port assignments.
 - c. Rack Enclosure Layouts – Provide drawings indicating the placement and arrangement of all rack equipment and panels.
 - d. Floor Plans – Provide scale floor plans indicating pathways, raceways, and conduits used for the system and equipment rooms. Include locations of all field devices including microphone communications stations, ambient sensors, and workstations as well as speaker zone boundaries.
 - e. Wiring Diagrams – Provide wiring diagrams detailing cabling for network, power, signal, and control. Identify terminal numbers and wiring color codes to facilitate installation, operation, and maintenance.
- B. Warranty Documentation – Provide a statement of warranty from the prime manufacturer of the system. Provide a comprehensive statement of warranty from the contractor covering all materials and labor installed.
- C. Record Documentation
- 1. Submit project record drawings of the as built condition indicating the location of public address system components and devices installed in the field. An AutoCad file of the building floor plans will be made available to the contractor for his use.
 - 2. Maintenance and Operations Manuals - The intention of this section is to require complete documentation of the integrated public address system for the purpose of system maintenance and operation during and after the warranty period.
 - a. Scope - Provide electronic drawings and maintenance and operations manuals of the completed system. These manuals shall include basic wiring diagrams, schematics and functional details such that all components, wires and pieces of equipment in the system may be easily identified by going to the actual equipment and making reference to this manual. It is required that everything in the system be neatly labeled and easily identifiable. Every terminal, wire, fiber, component, and piece of equipment, and all other such items shall have a number or letter designation. All of these identification characteristics shall be included in the maintenance manuals and the record drawings. Provide drawings in PDF format and the AutoCAD files for all system drawings. Provide one set of all schedules and tables in Microsoft Word or Excel formats. Maintenance manuals and drawings sets shall be compiled after system fabrication and testing, and shall incorporate all changes made after shop drawing submittal. The maintenance manuals and drawing books shall be permanently bound in metal hinged ring binders.
 - b. Maintenance Manuals, Manufacturer's Literature – Provide manufacturer's standard literature covering all equipment included in the system. The maintenance manuals shall contain specifications, adjustment

procedures, operation instructions and recommended maintenance if applicable.

- c. Drawings –Provide component identification and cross reference on the drawings to all allow the maintenance department to understand the function of each item (the block diagram), find the room where the device is mounted (contract document as-built drawings), find its location in the rack (rack up drawings), find how it is wired (on-line and wiring diagrams), its detailed specifications (vendor data sheets), and how to repair it (spare parts list).

1.6 QUALITY ASSURANCE

A. Regulatory Requirements

1. Install the system in accordance with NFPA-70 and other applicable local codes as approved by the AHJ.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Storage and Handling Requirements – Verify site conditions before delivery to the site. Store materials in areas that are clean dry and secure. Protect materials from damage. Advise the owner promptly if areas are not suitable for staging of materials for installation in accordance with the construction schedule.

1.8 WARRANTY

- A. The supplying contractor shall provide a warranty on the system which shall include all necessary labor and equipment to maintain the system(s) in full operation for a period of one year from the date of final acceptance of the entire system.
- B. Manufacturer shall provide, free of charge, product firmware upgrades throughout the 1 year warranty period for any product feature fixes.
- C. After the acceptance of the system(s) service shall be provided on the following basis:

Emergency Service - Provided 24 hours a day. When a total or catastrophic failure of equipment is reported to contractor, within 2 hours of notification, a service person will be on site. (An example of a catastrophic failure would be the main paging system failure)

Routine Service Provided within 4 business hours (9 a.m. to 5 p.m., Monday through Friday, excluding holidays) of notification. When a minor failure of equipment is reported to contractor, a service person will be on site within 24 hours of notification. (An example of a minor failure includes peripheral equipment such as amplifiers)

1.9 MAINTENANCE

- A. The contractor shall provide the necessary labor and transportation to maintain the system in compliance with the equipment manufacturer's specifications and the specifications contained herein during the warranty period. The price of the warranty period maintenance shall be included in the price of the baseline system

and each accessory, optional equipment, and other operational service feature and equipment. Maintenance as described herein shall be provided at no additional cost during the warranty period.

- B. Spare Parts: A quantity of three of each type of device provided as part of this system shall be provided, documented, and stored on site. Provide necessary spare parts after commissioning of system(s) and prior to final payment.
- C. Software and Firmware updates offered by the system manufacturer shall be provided to the Owner's Representative and installed in all systems free of charge while the systems are in their initial warranty period.

PART 2 - PAGING SYSTEM PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1. Bogen Communications, Inc. for speakers and amplifiers and paging controller

2.2 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with ANSI/ANSI/TIA-310-D.
- D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.3 POWER AMPLIFIERS

- A. Mounting: Rack.
- B. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
- C. Total Harmonic Distortion: Less than 1 percent at rated power output from 50 to 12,000 Hz.
- D. Frequency Response: 70Hz to 15k Hz +- 1 dB
- F. Bogen #TPU100B or #TPU250 based on quantity of speakers served.

2.4 TELEPHONE INTERFACE MODULE

- A. Universal telephone port interface with input for background music.
- B. Gain control for telephone and background music interface
- C. Emergency page override

- D. Rack mounting.
- E. Provide SIP enabled interface for VoIP Cisco telephone system and other input devices.
- F. Bogen #PCMTIM with SIP interface

2.5 CENTRAL PROCESSING MODULE

- A. Controls systems operations and holds programmed parameters
- B. Data link connection to additional CPU modules
- C. Bogen #PCMPCU

2.6 3-ZONE MODULES

- A. 3-paging zone outputs at 70V
- B. Background music inhibitor switch for each zone
- C. Bogen #PCMZPM

2.7 POWER MODULE

- A. Provides 12V DC @ 800mA to central processor module
- B. Bogen #PCMPS or equal

2.8 DIGITAL AUDIO PLAYBACK

- A. Provide (1) for background music source
- B. Rack mountable

2.9 LOUDSPEAKERS

A. 2'x2' Drop-Tile Mounted Speakers:

1. Frequency Response: 95 Hz to 20 kHz
2. Size: 8" main cone with secondary high frequency cone.
3. Minimum Dispersion Angle: 100 degrees.
4. Rated Output Level: 4 W.
5. Replaces a 2x2 ceiling tile.
6. Front-mounted volume control.
7. Bogen #CSD2x2VR

B. Gypsum Ceiling Mounted Speakers:

1. Frequency Response: 50 Hz to 12 kHz.
2. Size: 8" cone speaker
3. Minimum Dispersion Angle: 100 degrees.
4. Rated Output Level: 4 W.
5. Recessed Volume Control
6. Screw Terminals
7. Provide speaker enclosure.
8. Bogen #S86T725PG8WBRVR with RE84 speaker enclosure.

C. Wall-Mounted Loudspeakers:

1. Frequency Response: 95 Hz to 20 kHz
2. Size: 8" cone speaker
3. Minimum Dispersion Angle: 100 degrees.
4. Rated Output Level: 4 W.
5. Angled front
6. Recessed volume control.
7. Bogen #MB8TSL(VR)

2.10 CONDUCTORS AND CABLES

A. Speaker Level audio cable (70V)

1. 18 AWG, 2-conductor stranded cable
2. Jacket color: Grey
3. Plenum Rated.
4. West Penn #25224B or equal.

2.11 RACEWAYS

A. Conduit and Boxes: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be not less than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions – Verify site conditions before delivery to the site. Do not delivery electronic equipment to equipment rooms until they have finished surface finishes, are clean, and secure. Do not install field devices until surface finishes are complete and the areas are clean and secure. Advise the owner promptly if areas are not ready for system installation in accordance with the construction schedule. Advise the owner of site conditions that could result in reduced system performance or reliability
- B. Existing or newly renovated areas: Contractor may be providing speakers in areas either not undergoing renovation or previously renovated. In this case, contractor shall wear white cloth gloves when handling ceiling tiles and shall replace any damaged or broken tiles due to the work.

3.2 INSTALLATION

- A. The system shall be installed in accordance with NFPA 70 and other applicable local codes. Install the system in accordance with the manufacturers written instructions.
- B. Wiring Method: Install cables in raceways and j-hooks except within consoles, cabinets, desks, counters, and accessible ceiling spaces. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Comply with requirements for raceways and boxes specified in Division 26/27
 3. Provide j-hooks and fire rated sleeves/pathways exclusive of data cabling.
 4. Conceal conductors and cables in accessible ceilings, walls, and floors.
 5. The system cabling shall be installed with the highest level of workmanship. .
 6. In finished spaces wiring shall be installed above ceilings or within walls.
- C. Speaker Cable –Install cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours. Secure and support cables by rings, straps or other suitable fittings so designed and installed as to not damage cables. Secure cable at intervals not exceeding 36 inches and not more than 6 inches from every cabinet, box, or fitting. Do NOT run parallel to data, video, or voice cabling.
- D. Wiring within Cable Tray – Speaker Cabling running within the cable tray as other low voltage cabling must be contained within a partitioned compartment. If a separate compartment is not provide, provide cabling is j-hook systems adjacent to the cable tray. J-hook may be secured to the cable tray in this instance.
- E. Splices, Taps, and Terminations – Make splices, taps and terminations on numbered terminal blocks in junction boxes, terminal cabinets and equipment enclosures. No cable splices shall be permitted within conduit or in concealed spaces. Terminal and splice connections shall be made with pressure plate screw terminal blocks.
- F. Identification of Conduits, Cables and Equipment – All cabling, patch panels, terminal blocks and equipment shall be identified as reference to on the drawings unless otherwise approved by shop drawing submittal.

3.3 LABELING

- A. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
- B. Engrave and paint fill receptacle panels using 1/8" (minimum) high lettering and contrasting paint.
- C. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of rack-mounted equipment.
- D. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
- E. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
- F. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.

3.4 GROUNDING

- A. Verify the system power and safety ground has been installed in accordance with NFPA 70 and NEC Article 250.

- B. Telecommunication and Network Grounding shall be installed in accordance with ANSI/EIA/TIA-607.
- C. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk and other impairments.

3.5 SYSTEM INTEGRATION

- A. Provide interfaces to existing paging systems throughout the entire facility to provide a single method to make facility wide pages
- B. Provide temporary equipment and cabling as required to maintain the complete hospital wide system as required.
- C. Match input and output impedances and signal levels at signal interfaces as required. Provide matching networks where required.

3.6 ADJUSTING

- A. Upon completing installation of the system, perform operational programming, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.
- B. Upon completion of pre-testing, notify the Engineer a minimum of 10 days in advance of acceptance test.

3.7 QUALITY CONTROL

- A. Manufacturers Services – Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.
- B. Operational Test – Perform an operational system test to verify conformance of system to these specifications. Perform tests that include originating program material distribution, page material distribution, message distribution coordination, zone distribution selection, message assembly, test and monitoring functions, and ambient noise control operation. Observe sound reproduction for proper volume levels and freedom from noise and distortion. Provide a written record of test results.
- C. Occupancy Adjustments - When requested by the engineer or owner within one year of the date of substantial completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide up to (3) visits for this purpose.

3.8 CLOSEOUT ACTIVITIES

- A. Demonstration – Provide an acceptance demonstration to the facilities management group (owner) and engineer. This demonstration should include all major features of the system including making announcements, initiating messages, initiating message sequences, TCAS announcements, password security, reviewing test results, etc.

B. Training – Train maintenance and operation personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system.

1. Training at the facility – Provide a minimum of 8 hours of follow-up maintenance and operation training on site at the facility.

3.9 SYSTEM VERIFICATION AND ACCEPTANCE

- A. After completion of the system installation, and after the Contractor's preliminary tests and adjustments have been completed, the contractor in conjunction with the Owner's Representative shall perform on-site commissioning of the system. This process will consist of complete system check-out, and tailoring of the technical system operation to specific needs of the Owner's Representative.
- B. Proof of performance of the system shall be conducted in the presence of the Owner's representative. Any equipment, system interfaces, or software not meeting specifications and the satisfaction of the Owner's Representative shall be remedied or replaced to the satisfaction of the owner. These tests shall be conducted after the Contractor has adjusted the system to his satisfaction.

3.10 SCHEDULES

- A. Prior to zoning speakers, coordinate with the owner for exact zoning. Adjust and add zones as required. Completed system shall have 3 spare zones for the renovated area.

END OF SECTION

SECTION 28 10 00

ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. The scope of work for the Access control system (ACS) is to provide a new access control system as required by the new building construction. Provide all equipment, devices, cabling, pathways, installations, etc. as required for a complete installation.
- B. Access control is being included as part of the electrical contractor's scope and shall be installed and serviced by **In-Telecom** (No exceptions).
- C. The Access control system must support at minimum the following features:
 - 1. Access control.
 - 2. Historical event reporting.
 - 3. Employee identification

1.2 LOCATION OF SYSTEM COMPONENTS

- A. Intelligent Controllers (IC) and power supplies will be located in Telecom (Data) Rooms throughout the building. All cabling for access control, door release, etc. will route to these locations.
- B. Card readers, electric locks, door contacts, touchless door operators, and other devices as shown on the drawings.

1.3 FUNCTIONAL REQUIREMENTS

- A. Primary Function
 - 1. The integrated security management system's (SMS) primary function shall be to regulate access through specific doors to secured areas of the building and monitor alarm points.
 - 2. The SMS must be able to connect to and monitor field hardware devices such as card readers and IFPs. Administrative tasks such as defining access groups, time zones, report generation, displaying maps, etc., shall be provided from any security workstation on the network.
 - 3. All the data must reside in a single database.
 - 4. The SMS must be designed to perform a wide variety of features and functions. These system functions can be categorized into "system modules" which shall include:
 - a. Access control
 - b. ID management

- c. System administration
- B. Access Control: One of the SMS's primary purposes shall be to provide access control. The SMS shall be able to make access granted or denied decisions, define access levels, and set time zones and holidays. An input/output linkage feature will allow linking of monitor zone points to output control points within Intelligent Controllers (IC).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Motorola Avigilon., No equal.

2.2 SOFTWARE

- A. All software and hardware provided under this scope of work shall be the latest version available. In addition, this scope shall include software upgrades for one year following date of final system acceptance.
- B. Provide software licensing so access control and alarm monitoring are available at all security system workstations.
- C. System shall come standard with 1 year of software upgrade and support included.
- D. The system shall integrate all access control functionality into a single database in a network capable environment. The system shall allow the incorporation and integration of servers, access control client workstations and digital video viewing workstations sharing the same data- base on a local area or wide area network. The SMS shall allow future expansion to include additional workstations without losing functionality.

2.3 FIELD HARDWARE DEVICES

- A. Intelligent Controller (IC)
 - 1. The first controller of every Location is designated as the "Primary". All subsequent controllers at the same Location are designated as "Secondary". Any controller may be selected by dipswitch settings to work as the Primary controller. The Primary controller performs all the same functions as a Secondary controller, but it is also responsible for polling all Secondary controllers and communicating with the host PC. The Primary controller does not make any access decisions for the Secondary controllers. It is simply the messenger for information from the controllers to the PC and for information from the PC to the controllers.
 - 2. Controller operating system resides in Flash ROM on each controller. It is upgradeable thru a download from the Host PC to each of the controllers in the system. Upgrades in controller operating system shall NOT require PROM changes.
- B. Card Readers

1. The access control system shall support a variety of card readers which shall encompass a wide functional range. The system may combine any of the readers described below for installations requiring multiple types of reader capability (i.e., card only, card and/or PIN, supervised inputs, local database, etc.).
2. The card shall be read when presented in any orientation to the surface of the reader. A multicolor LED on the front face of the reader shall show the user that the card was read and an access decision was made. LED shall be red to show door is locked and shall be green to show door is unlocked. LED shall hold the green color is unlocked during the day.
3. Do not place card reader wiring in conduit with AC power / lock power. Maintain at least 12" distance from other wiring such as, signal wiring, electric locking devices, AC power, etc.
4. Card readers shall be able to support a user defined downloadable off-line mode of operation (locked, unlocked, or facility code) which shall go in effect during loss of communication with the IFP.
5. All card readers shall provide audible feedback to indicate access granted/denied decisions.

C. Door Hardware

1. All electric locking hardware (electric strikes) shall be provided by the Contractor through the Electrical Contractor. Coordinate with general contractor.
2. Access control contractor shall coordinate with the door hardware supplier to coordinate rough-in and security infrastructure requirements for EACH door. ACS Contractor shall coordinate with door hardware supplier for all door hardware requirements and lead all hardware coordination efforts
3. The access control contractor shall provide all interconnections/coordination between the security system and the door hardware or any other equipment that will interface with the security management system. This includes routing of cables to electric locks and hinges.
4. All low voltage security electric door hardware shall be 24VDC except as noted otherwise in the door hardware spec.
5. Access control contractor shall provide and install low voltage cabling and connection to all automatic door operators and actuator buttons.
6. Monitor delayed egress activation on any lock with delayed egress capability via the access control system.
7. Provide any relays necessary to properly interface the access control system to the electric locks, automatic door operators, fire alarm relays, and other electric door hardware field components.

D. Field Hardware Power Supplies

1. Power supplies for locks shall be UL listed and be designed specifically for the equipment installed. All power supplies shall be housed in tampered, locked enclosures. Provide a minimum 0.75 amp, 24VDC power per locking device (please be aware that some doors have multiple locking devices, provide 0.75A per device). Power supplies must meet or exceed in-rush current capacities of locking devices. Power to locks shall be individually fused or PTC protected. The power control board shall have direct input for fire alarm panel.

2. Each output shall be individually selectable for Fail-Safe or Fail-Secure operation. Use Altronix power supplies with ACM control boards or equal.
3. All power supplies shall be located in the telecom rooms and not localized to the door, unless prior permission is granted.

2.5 CARDS

A. Access Cards

1. Provide 1000 compatible cards as part of project.

2.6 MISCELLANEOUS FIELD HARDWARE

- A. Remote Release buttons shall be United Security Products HUB-2SA or equal momentary re- mote release button.
- B. Door contacts shall be GE 1078 or equal 1" circular magnetic contacts for flush mount and GE 2500 series or equal for surface mount.
- C. Request to exit motion sensors shall be Bosch DS160 series or equal.
- D. Touchless door operators (hand waves) shall be provided by access control contractor and shall match FMOL standard operator or be equal to.
- E. Emergency Release push buttons shall be Dortronic 5211 series or equal. Button shall mount to a single gang box. "EMERGENCY RELEASE" shall be engraved on the plate. The button shall be red.

1. The button shall incorporate a pneumatic time delay relay which will maintain the mag- lock to unlock for a period of 30 seconds.

2.7 CABLE

- A. All system cable shall be of the highest quality. Cables shall be riser rated unless otherwise noted. No splices are allowed except in designated junction boxes above doors.
 1. Provide composite cable. Provide individual interior cables for each door component. At minimum provide 18awg/4C for Lock Power, 22awg/6C for Card Reader, 22awg/2C for Door Contact and 22awg/4C for Request-to-Exit.
 2. All low voltage cable shall be UL listed and NEC certified as Class 2/Class 3 or CMR (in non air space) or CMP (in air space)
 3. All system cable shall be approved by the relevant manufacturer for use with their equipment.
- B. The access control contractor shall provide all cables required for a functional Access Control System and all components listed in this specification.

PART 3 - EXECUTION

3.1 EXECUTION AND INSTALLATION

- A. Provide a complete and functional SMS as described within these specifications and drawings. The system shall be installed utilizing good wiring and grounding practices according to local and national codes and acceptable to the engineer. Local and national life safety and fire codes shall be strictly followed where applicable. The contractor shall install the system using skilled workmanship and of acceptable quality.
- B. Deliver all software licenses to Owner in 3-ring binder with licenses inserted in clear, sealable holders.
- C. Install all equipment and materials in accordance with the current manufacturer recommended standards. The work shall also be in accordance with:
 - 1. Installation Criteria defined in these specifications and in the construction documents.
 - 2. Approved Submittals (including product datasheets and drawings showing installation methods).
 - 3. Applicable Requirements of Referenced Standards.
- D. Provide installation of all system components in a straight and neat order. Refer to plans for exact system component locations.
- E. Route security cabling along dedicated J-hooks in areas where cable tray is not present. You are to provide and install J-hooks for security cabling. Security cabling is permitted in the cable tray. You must bundle security cables together within tray separate from data cables and adhere to the same rules as described in the communications specifications for routing cables in the tray.
- F. Fasten card readers securely in place.
- G. Cable splices are not permitted.
- H. Provide coordination with security personnel for the installation of system components at each door.
- I. Provide complete system start-up, load software and provide system programming.
- J. Provide wiring meeting system manufacturer's recommendations.

3.2 PROGRAMMING

- A. Provide all programming required for all new access control installations.

3.3 TESTING

- A. Operational Testing: The Contractor shall perform thorough operational testing and verify that all system components are fully operational.
- B. Hardcopy System Printout: The Contractor shall submit a system printout of all components tested and Certify 100% operation indicating all devices/panels/units have passed the test criteria set forth by the Manufacturer.
- C. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the Contractor prior to the acceptance walk-through. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the Contractor (Pass/Fail), and an empty column for recording findings during the walk-through.

3.4 TRAINING

- A. Provide minimum of (8) hours of user and system administration training (for the access control system) by a qualified, factory approved person at time of turnover to Owner.

END OF SECTION

SECTION 28 31 11

DIGITAL ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE OF WORK:

- A. The scope of work includes the design and documentation of a complete fire alarm system. It includes the furnishing and installation of all components necessary to provide fire detection, occupant notification (voice evacuation), emergency forces notification, communication and fire safety functions to meet the requirements of the drawings, these specifications, applicable building codes, NFPA 72, and the requirement of all authorities having jurisdiction. The new fire alarm system shall integrate with the existing hospital fire alarm system and shall communicate between control panels. Provide all extensions, modifications, connections, programming, cabling, conduit, etc. between control panels as required for a complete installation. The owner **shall not** incur any costs associated with a non functional, non integrated fire alarm system.
- B. The contract documents depict the scope of the work and set forth minimum requirements and standards for the system. In the event there is a conflict between the minimum standards of the contract documents and the requirements of the AHJ, the requirements of the AHJ shall apply.
- C. The system shall include:
 - Fire Alarm Control Panel
 - Voice Evacuation Panel
 - Remote Annunciator Panel
 - DACT
 - Auxiliary remote extender and power supply panels
 - Addressable manual fire alarm pull stations.
 - Addressable analog smoke detectors.
 - Addressable analog smoke detectors, beam detector type.
 - Addressable analog heat detectors.
 - Addressable analog duct smoke detectors.
 - Addressable intelligent interface modules and control relays
 - Audible and visual notification appliances
 - Battery standby.

1.02 QUALITY ASSURANCE:

- A. Standards: The following apply as minimum standards for the work:

NFPA 70	National Electrical Code
NFPA 72	Standard for the Installation, Maintenance and Use of Protective Signaling Systems.
ADA-AG	Americans with Disabilities Act - Accessibility Guidelines

- B. All devices, combinations of devices, notification appliances, control panel components, and other equipment utilized shall be listed by the Underwriters Laboratories, Inc. (UL) for the protective signaling purpose for which they are used, including listing for use with the existing fire alarm control panel.
- C. The fire system equipment shall be installed by NICET certified installers. The Installer, who performs final checkout, contractual service and testing, shall be Listed and Authorized by UL to provide services for alarm system certification as a means of identifying compliance with applicable NFPA Standards.

1.03 FIELD VERIFICATION OF EXISTING CONDITIONS

- A. Field verify location of all existing devices including initiating devices, notification appliances, control modules, wiring, and power supplies within the area of work. Actual locations, quantities, and interconnection of existing devices to remain in use are not reflected in submittal drawings. Remove existing devices and associated cabling that interferes with finished design intent. Field verify location of existing fire alarm control panel and provide conduit lengths required to interconnect to new fire alarm control panel to electrical contractor prior to bid. Electrical contractor shall include all conduits required for interconnection to existing hospital control panel

1.04 TESTING OF EXISTING SYSTEM

- A. Perform tests prior to beginning work to determine the actual condition of the hospital's existing fire alarm system/control panel. Deficiencies found shall be included in a written report to the Architect. Testing shall be completed and the report provided to the Architect within 14 days from the notice to proceed with the work. The Architect will refer deficiencies contained in the initial report to the Owner for correction by the Owner prior to the beginning of the work.

1.05 SUBMITTALS & CERTIFICATION

- A. Provide submittal documents and drawings for review by the Architect and the Louisiana State Fire Marshal. Submittal documents and installation drawings shall be prepared by the contractor to comply with the system documentation standards set forth in NFPA 72, the contract documents, and shall comply with all requirements of the reviewing agencies. These documents and drawings shall be submitted to the architect for review and to the reviewing authorities for approval prior to beginning work.
- B. When all work has been completed, the Installer shall so certify to the Owner in writing. Include a copy of the certification in the Project Documentation. Certification shall be in accordance with NFPA 72. As a condition for final acceptance, the control panel shall be tagged with the green tag required by the Fire Marshal for occupancy and system operation.

PART 2 - FIRE ALARM SYSTEM AND SYSTEM EQUIPMENT

2.01 SYSTEM FUNCTION

- A. The finished system shall be complete and electrically supervised. The system shall include new voice evacuation equipment as required for a complete installation. Meet with Engineer and owner prior to start of work for coordination. Coordinate with architect, owner, and engineer for exact zoning requirements.

2.02 SYSTEM ALARM OPERATION

- A. Activation of any fire alarm initiating device or alarm-causing intelligent interface module shall result in the alarm initiating and fire safety functions required of the system.
- B. Fire Safety Functions: The fire alarm system shall interface with the HVAC control system and the access control system. HVAC equipment interface is defined by the sequence of operations for the HVAC system. Access control requirement shall consist of releasing locked doors in the egress path under alarm conditions. In addition, the fire alarm system shall release magnetic hold-opens in rated openings under alarm conditions. Smoke detection is required at smoke dampers and other duct locations indicated on the mechanical drawings.

2.03 FIRE ALARM CONTROL PANEL:

- A. The main fire alarm control panel shall be a Simplex 4100ES Expandable Emergency Evacuation fire alarm control panel. System shall include a Voice Evacuation Panel as required and shown on the drawings.
- B. The standby power source shall meet the requirements for standby capacity as detailed in paragraph 1-5.2.6, NFPA 72, supervisory for 60 hours for auxiliary and remote station systems. Additionally, the supply shall be capable, at the end of this period of operating the system with all evacuation appliances active for a period of five minutes using conventional signaling or fifteen minutes using voice evacuation.

Provide new Fire Alarm Remote Annunciators and locate at building entrance.

Provide new Fire Alarm Remote Power Supplies as required and connect to existing fire alarm control panel as required.

2.06. SYSTEM INTELLIGENT ALARM INITIATION DEVICES AND CONTROL MODULES:

- A. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary. The system shall include an isolation module for every group of 25 or less addressable devices.
- B. Smoke Detectors shall be listed for use as open area protective coverage and shall be insensitive to air velocity changes. Detectors shall be addressable type mounted in in-duct housing. Where duct smoke detectors are mounted

above ceilings or otherwise obstructed from normal view, they shall be provided with a remote alarm indicator.

- C. Heat Detectors shall be rated at 135 degrees.
- D. Detector bases shall be low profile twist lock types with screw clamp terminals and self-wiping contacts.
- E. Provide Manual stations where shown. Install stations within five feet of egress doors. If not achievable, confirm location on site with architect.
- F. Provide control modules as required for the application.
- G. If required by ceiling heights, provide beam detector style smoke detectors.

2.07. EVACUATION SIGNALING APPLIANCES:

Visual Notification Appliances:

Visual appliances shall be installed as in accordance with the requirements of the U.L. 1971 standard and NFPA 72. Where multiple visual signals are visible from any location, circuitry shall be incorporated for the synchronization of the flash rate.

Devices shall be UL 1971 Listed for Emergency Devices for the Hearing-Impaired in all public mode installations, and shall produce a flash rate of one (1) flash per second minimum over the listed input voltage (20 VDC - 31 VDC) range. All visual signals shall incorporate a Xenon flash tube enclosed in a rugged lens with solid-state circuitry. The strobe intensity shall be rated per UL 1971 for 15, 30, 75, 90, or 110 Candela. All devices shall include selectable candela intensity.

The strobes shall be available for semi-flush or surface mounting and in conjunction with audible signals.

Audible evacuation signals:

Audible Notification appliance shall be Voice/Tone notification type and shall comply with UL1480. Appliances shall match existing in type and finish. Provide additional audible notification devices as required to provide evacuation notification that is audible to all occupants and as required by the AHJ.

In addition to other visual and audio/visual notification appliances required by the drawings and specifications, provide a quantity of 24 audio/visual devices, each having selectable candela ratings. Install these devices in locations as may be required by the Fire Marshal either at the time of submittal review or during the Fire Marshal's inspection of the work (this includes installation, cabling, programming, etc.). If the additional devices are not required by the Fire Marshal, deliver them to the Owner for use as spares.

PART 3 - EXECUTION

3.01 CONTINUITY OF SERVICE

- A. The existing fire alarm system shall remain in continuous service throughout the period of construction except with prior written approval of the Architect.
- B. During construction, provide heat detectors for all smoke detectors within project scope. Prior to turning project over to owner, reinstall smoke detectors as required.

3.02 WIRING METHODS:

- A. Install wiring in accordance with NEC and NFPA 72 requirements. Install wiring concealed above ceilings and in walls. Where run exposed, install wiring in conduit. Conduit shall be painted red where visible.

3.03 COORDINATION WITH FINISHES

- A. Coordinate installation of all fire alarm devices with all architectural wall and ceiling finishes. Architect reserves the right to relocate devices up to 10' from their original location. Prior to procuring equipment, coordinate with architect for all device locations.

END OF SECTION

SECTION 316329 – DRILLED, CAST-IN-PLACE CONCRETE SHAFTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. All work under this section shall be performed under one subcontract, the scope of which shall include, in addition to all drilling, the furnishing and placement of all concrete and reinforcing steel.
- B. Provide all material, labor and equipment necessary to construct all drilled, cast-in-place concrete shafts as indicated on the Plans and as hereinafter specified.
- C. Drilling of the shafts and placing of the concrete fill shall be executed under the supervision of an experienced foreman.
- D. It shall be the Contractor's responsibility to install the drilled, cast-in-place shafts by whatever means is necessary, such as casing the excavation, utilizing drilling mud or slurry and place the concrete with a tremie, or such other methods meeting the Architect's approval.
- E. All of the above, including any extra concrete, etc., shall be performed by the Contractor at no additional cost to the Owner.
- F. The installation and load testing of one shaft is included in this section.

1.02 QUALITY ASSURANCE

- A. A recognized testing laboratory approved by the Architect and Structural Engineer is to perform the specified testing and inspection and furnish to the Architect and Structural Engineer, the results of such tests and inspections. Also see Section 01 45 29 – TESTING LAB SERVICES.
- B. The testing laboratory shall be on the job at all times during the installation of the shafts. No shafts will be allowed to be installed without the presence of the testing laboratory.
- C. The testing laboratory shall provide the following services:
 - 1. Furnish the calibrated jacks, scales, instruments, etc., and conduct the loading of the test shaft.
 - 2. Visually inspect each hole making sure that all loose and unsound material and water has been removed prior to placement of concrete.
 - 3. Verify the depth, diameter and volume of concrete for each shaft. Make a minimum of four (4) cylinders per day or four (4) per fifty (50) yards, whichever is greater and perform compression tests at seven (7) days and twenty-eight (28) days.
 - 4. Make a minimum of four (4) slump tests per day or one (1) per twenty-five (25) yards, whichever is greater.

5. Copies of the soil report are on file at the offices of the Architect and Structural Engineer and it shall be the Contractor's responsibility to visit either of these offices and avail himself of this information in the preparation of his bid.

1.03 SUBMITTALS

Submit for review six (6) sets (or an electronic set) of detailed shop drawings showing layout, sizes, arrangements, etc., for reinforcing steel in accordance with the requirements of General Conditions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Removable steel casing of sufficient length large enough to allow the reamer to pass through.
- B. 4000 psi concrete mixed and placed in accordance with SECTION 03 30 00 – CAST-IN-PLACE CONCRETE, except that the mix shall contain not less than six (6) sacks of cement per cubic yard and the coarse aggregate size shall not exceed $\frac{3}{4}$ " and it shall have a minimum slump of 5". If a casing is required, a "superplasticiser" that reduces the amount of water used and a retarder shall be added to insure that the concrete remains "flowable" during the entire installation, particularly during removal of the casing.
- C. 60,000 psi yield steel as specified under SECTION 03 30 00 – CAST-IN-PLACE CONCRETE. Circular ties shall be provided when called for on construction documents.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Drilled shafts shall be machine drilled, cast-in-place concrete shafts. The lengths and diameters shall be as indicated on the Plans.
- B. Holes shall be drilled vertical and to the lines and dimension indicated on the Plans. Centers shall not vary more than 3" from the position shown on the Plans.
- C. Should variation exceed the above, the Contractor shall be required to make all necessary changes as directed by the Architect at the Contractor's expense.
- D. Single or multiple casing, if required, shall be set in such a manner as to seal off the inflow of water and prohibit the side walls from sloughing.
- E. Prior to placement of concrete, all water and loose material shall be removed. A funnel or other such acceptable piece of equipment shall be used while placing concrete so as to insure that the concrete falls straight down and does not bounce against the side walls or reinforcing steel.
- F. After the concrete has been poured, the casing shall be carefully removed as soon as possible while the concrete is still "flowable" so as to minimize the possibility of "necking" of the shaft.
- G. Placing of the concrete fill and reinforcing steel shall be accomplished as soon as possible after the hole has been drilled and all loose and unsound material and water removed.

- H. Placing of the concrete fill through drilling mud or slurry shall be with a tremie extending to the very bottom. The mud or slurry shall be entirely displaced by the concrete before pulling the casing. Where mud or slurry is utilized in the installation, the shafts shall be poured approximately 12" higher than necessary to insure that all mud or slurry has been displaced with uncontaminated concrete. After this has been done, the excess concrete may be removed to required grade.

3.02 TEST SHAFT

- A. The Contractor shall include in his bid the installation and load testing of one shaft. The test shaft shall have the same diameter as the most common shaft on this job. The depth of the test shaft shall be as shown on the construction documents.
- B. The test shaft will be utilized as a permanent shaft in the structure.
- C. The Contractor must employ a civil/structural engineer, licensed to practice in the state where this job is located, to design the test shaft apparatus. The Contractor will be required to submit this sealed design to the Architect for approval, including detailed plans of the loading apparatus he intends to use. In designing this apparatus, care must be taken to allow the various increments of the load to be placed gradually without causing vibration in the test shaft.
- D. During the test loading, the shaft shall be free from any artificial bracing and the material around the shaft shall be removed from cut-off up to the existing ground surface.
- E. The test shaft shall be loaded by means of a hydraulic jack reacting against a beam fastened to anchor shafts around the test shaft. Anchor shafts shall be a clear distance from the test shaft at least five times the maximum diameter of the anchors, but not less than 7'.
- F. The test shaft shall be allowed to stand undisturbed for at least fourteen (14) days after having been installed to the required depth before beginning loading operation.
- G. The shaft shall be test loaded to twice the design load as specified in the Geotechnical Report for this project, and then on to failure after rebound readings have been taken but not more than three times the design load.
- H. The test shaft shall be loaded and tested in accordance with the short loading procedure of ASTM D 1143.
- I. In the event that the results of the test shaft should require modifications to the shaft layout, the contractor shall supply unit prices in price per linear foot for each shaft diameter shown on the plans.

END OF SECTION