

PROJECT MANUAL FOR:

PRE-ENGINEERED BUILDING

LAKES REGIONAL HEALTHCARE
2323 US-71
SPIRIT LAKE, IA 51360

BID DOCUMENTS
06/01/2026

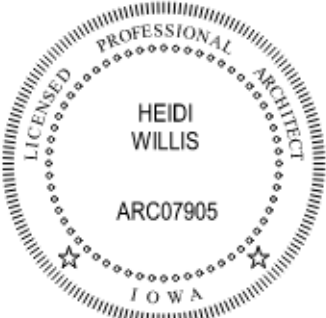
DIVISIONS 00-33

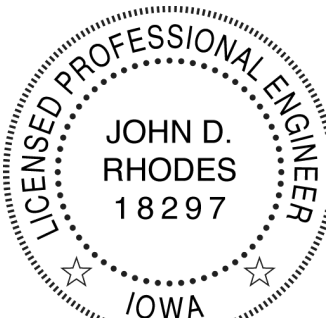


1312 Locust St. Suite 204
Des Moines, IA 50309

Project #26022

SECTION 00 01 07
SEALS & SIGNATURES

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Architect under the laws of the State of Iowa. Name: Heidi Willis <u><i>Heidi Willis</i></u> <u>5/29/2026</u> Signature Date Registration Expires: June 30, 2027 Iowa Reg No. 07905 Divisions: 01 thru 14, as indicated in TOC with "A"

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Structural Engineer under the laws of the State of Iowa. Name: John D. Rhodes <u><i>[Signature]</i></u> <u>05/29/26</u> Signature Date Registration Expires: December 31, 2026 Iowa Reg No. 18297 Sections: 03000, as indicated in TOC with "S"

	I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Engineer under the laws of the State of Iowa. Name: Sara Schmerbach <u><i>Sara Schmerbach</i></u> <u>5/28/2026</u> Signature Date Registration Expires: December 31, 2026 Iowa Reg No. 25319 Divisions: 22 & 23, as indicated in TOC with "M"



I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly Licensed Professional Engineer under the laws of the State of Iowa.

Name: Richard K. Larson

5/29/26

Signature

Date

Registration Expires: December 31, 2027

Iowa Reg No. 16014

Divisions: 26, 27 & 28, as indicated in TOC with "E"

END OF SECTION

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NOTICE TO BIDDERS**

NOTICE IS HEREBY GIVEN: That sealed bids will be received by the Lakes Regional Healthcare, at the Big Spirit Conference room in Lakes Regional Healthcare, 2323 US-71 N, Spirit Lake, IA 51360 until 2:00 PM CDT on the 23rd day of June, 2026. The bids will be opened at 2:05 PM in the same location and publicly read aloud. The project consists of furnishing the supplies, equipment, and/or services to construct:

**PRE-ENGINEERED BUILDING
LAKES REGIONAL HEALTHCARE
2323 US-71 N, SPIRIT LAKE, IA 51360
UNISON DESIGN STUDIO PROJECT NO. 26022**

The bids are for a single Prime Contract for construction of a 48' by 60' pre-engineered wood framed building with an office and restroom.

A Public Hearing will be held at 7:00 A.M. on June 24, 2026, in the Big Spirit Conference room in Lakes Regional Healthcare, 2323 US-71 N, Spirit Lake, IA 5136, in accordance with the provisions of Chapter 384, Code of Iowa. At said hearing any interested person may appear and express their views, either orally or in writing, on the proposed plans & specifications, form of contract, or project costs for the construction of the maintenance building. At the hearing, the Board will receive and consider any objections made by any interested party, if any, to the proposal. After hearing objections, the Board will enter its decision on the construction of a building for Lakes Regional Healthcare.

A virtual pre-bid conference is scheduled for Thursday, June 11, 2026 at 2:00 P.M. at the following link:

- i. Join Zoom Meeting:
<https://us05web.zoom.us/j/83452282722?pwd=99rcHSmlBDeZ6xYXkqefumn0HOSwgl.1>
- ii. Meeting chat link
<https://us05web.zoom.us/jc/83452282722>
- iii. Meeting ID: 834 5228 2722
- iv. Passcode: 113794
- v. One tap mobile -
+13017158592,,83452282722#,,,,*113794# US (Washington DC)
+13052241968,,83452282722#,,,,*113794# US
- vi. Join by SIP - • 83452282722@zoomcrc.com
- vii. Join Instructions:
<https://us05web.zoom.us/join/83452282722/invitations?signature=qNQdDpt4pmBa1AvNLhTLLqEaw1cU4291PYVyPwwc0AY>

The Owner intends to issue a notice to proceed June 24, 2026.

Work is anticipated to commence upon award of contract or Notice to Proceed, on or about, June 24, 2026, and be substantially complete by September 30, 2026, constructed in a single phase as shown on the Contract Documents.

Plans and specifications governing the construction of the proposed Work have been prepared by Unison Design Studio of Des Moines, Iowa.

Direct questions to Heidi Willis, AIA, 563-419-4986; heidw@unisonsds.com, or the design professionals identified within the Project Directory (drawing cover sheet).

Proposed drawings, specifications, and form of contract may be examined at the office of the Gary Ven Wattering, Lakes Regional Healthcare, 2323 US-71 N, Spirit Lake, IA 51360.

Copies of the Bidding Documents may be obtained through Iowa Reprographics, via their website at <https://iowarepro.com/>, by phone at 515-244-5705; or in person at 3 College Street, 3 College Ave Unit 3, Des Moines, IA 50314, in accordance with the Instructions to Bidders.

Bidders for the Contract may obtain one (1) set of the Bidding Documents in accordance with the Instructions to Bidders upon receipt of a refundable deposit, by certified check in the sum of \$100.00 or a MBI Plan Deposit card for each set of documents.

- A. Shipping costs will be determined by the printer and paid directly to them if shipping is desired. Deposit will be refunded if Bid Documents are returned complete, undamaged, unmarked and reusable, within fourteen (14) days of bid submission. Failure to comply will result in forfeiture of deposit.

All bidders may register for free access to this Project at <https://iowarepro.com/>. Once logged onto the project through the public planroom, bidding documents may be downloaded, viewed and printed.

Documents may also be viewed at the following plan rooms:

1. Construction Update Online Plan Room; Master Builders of Iowa, 4100 Westown Pkwy, West Des Moines, IA 50266, 515-288-8904; <http://www.mbionline.com>
2. Iowa Reprographics, 3 College Street, 3 College Ave Unit 3, Des Moines, IA 50314; <https://iowarepro.com/>, (515) 244-5705.

Bid security in the amount of 5% of the total bid in the form of certified check, credit union share draft, or surety bond written on an original AIA Document A310, Bid Bond is required for this project, and must be submitted at the time of bid. The successful bidder will be required to provide surety Performance and Payment Bonds in an amount equal to one hundred percent (100%) of the Contract Sum.

Refer to other bidding requirements described in Instructions to Bidders.

Submit your offer on the Bid Form provided.

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

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

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

By order of the LRH Board of Trustees

END OF SECTION

**SECTION 00 21 13
INSTRUCTIONS TO BIDDERS**

SUMMARY

1.01 DOCUMENT INCLUDES

- A. Invitation to Bid.
 - 1. Bid Submission
 - 2. Intent
 - 3. Work Identified in Contract Documents
 - 4. Contract Time
- B. Bid Documents and Contract Documents
 - 1. Definitions
 - 2. Contract Documents Identification
 - 3. Availability
 - 4. Examination
 - 5. Inquiries/Addenda
 - 6. Product/Assembly/System Substitutions
- C. Site Assessment
 - 1. Site Examination
 - 2. Prebid Conference
- D. Qualifications
 - 1. Qualifications
 - 2. Subcontractors/Suppliers/Others
- E. Bid Submission
 - 1. Submission Procedure
 - 2. Bid Ineligibility
- F. Bid Enclosures/Requirements
 - 1. Security Deposit
 - 2. Performance Assurance
 - 3. Insurance
 - 4. Bid Form Requirements
 - 5. Fees for Changes in the Work
 - 6. Bid Form Signature
 - 7. Additional Bid Information
 - 8. Selection and Award of Alternates
- G. Offer Acceptance/Rejection
 - 1. Duration of Offer
 - 2. Acceptance of Offer

1.02 RELATED DOCUMENTS

- A. Document 01 10 00 - Summary.
- B. Document 00 11 13 - Notice to Bidders
- C. Document 00 31 00 - Available Project Information.
- D. Document 00 41 00 - Bid Form.

INVITATION

2.01 BID SUBMISSION

- A. Bids signed, executed, and dated will be received at the Big Spirit Conference room of Lakes Regional Healthcare at 2323 US-71 N, Spirit Lake, IA 51360 before 2:00 p.m. local standard time on June 23, 2026.

1. Access: Use the East Entrance L and then use the elevator to go to Level B and the Big Spirit Conference Room.
- B. Offers submitted after the above time will be returned to the bidder unopened.
- C. Offers will be opened publicly immediately after the time for receipt of bids.
- D. Submit your offer on the Bid Form provided. Bidders may supplement this form as appropriate.
- E. Successful bidders will be notified of award on or after June 24, 2026.

2.02 INTENT

- A. The intent of this Bid request is to obtain an offer to perform work to complete project named LRH Pre-Engineered Building for a Stipulated Sum contract, in accordance with Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises building construction and site development, including general construction, structural, mechanical, electrical, and Site Work.

2.04 CONTRACT TIME

- A. Perform the Work within the time stated in Section 00 41 00 - Bid Form.
- B. The bidder, in submitting an offer, accepts the Contract Time period stated for performing the Work. The completion date in the Agreement shall be the Contract Time added to the commencement date. The bidder may suggest a revision to the Contract Time with a specific adjustment to the Bid Amount.

BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

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

3.02 CONTRACT DOCUMENTS IDENTIFICATION

- A. Contract Documents are identified as Project Number 26022 as prepared by Unison Design Studio and their consultants, and with contents as identified in the Table of Contents of the Project Manual and Index of Sheets on the Drawings.

3.03 BIDDER'S REPRESENTATIONS

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

3.04 AVAILABILITY

- A. Bid documents may be obtained through Iowa Reprographics, <https://iowarepro.com>, 515-244-5705.
 1. Call ahead to ensure copies will be available for pickup at your selected location.

- B. One sets of Bid Documents can be obtained by bidders upon receipt of a deposit, by cash, in the amount of \$100.00 for one set.
- C. Deposit will be refunded if Bid Documents are returned complete, undamaged, unmarked and reusable, within 14 days of bid submission. Failure to comply will result in forfeiture of deposit.
- D. Shipping costs will be determined by the printer and paid directly to them if shipping is desired.
- E. 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.
- F. Bidder shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.05 EXAMINATION

- A. Bid Documents may be viewed at the office of Gary Van Wattering, Lakes Regional Healthcare.
- B. Bid Documents are available online at www.iowarepro.com
- C. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.
- D. Immediately notify Architect upon finding discrepancies or omissions in the Bid Documents.

3.06 INQUIRIES/ADDENDA

- A. Direct questions to Heidi Willis, email: heidew@unisonsds.com; or phone (563) 419-4986; or the design professionals identified within the Project Directory (drawing cover sheet).
- B. Addenda may be issued during the bidding period. All Addenda become part of Contract Documents. Include resultant costs in the Bid Amount.
- C. Verbal answers are not binding on any party.
- D. The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect error, inconsistencies or ambiguities discovered.
- E. Clarifications requested by bidders must be in writing not less than 7 days before date set for receipt of bids. The reply will be in the form of an Addendum, a copy of which will be forwarded to known recipients and plan holders.
- F. Addenda will be issued through the plan rooms not later than 48 hours before bid opening.
- G. Each bidder shall indicate receipt of addendum on bid form.

3.07 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 acceptability of proposed substitutions.
 - 4. Provide complete information on required revisions to other work to accommodate each proposed substitution.
- B. Substitution Request Time Restrictions:
 - 1. Where the Bid Documents stipulate a particular product, substitutions will be considered up to five (5) days before receipt of bids.
- C. Substitution Request Form:
 - 1. Submit substitution requests by completing the form in Section 01 60 10.01. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- D. 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.
- E. In submission of substitutions to products specified, bidders shall include in their bid all changes required in the Work and changes to Contract Time and Contract Sum to accommodate such substitutions. A later claim by the bidder for an addition to the Contract Time or Contract Sum because of changes in work necessitated by use of substitutions shall not be considered.
- F. See Section 01 60 10 - Substitution Procedures for additional requirements.

SITE ASSESSMENT

4.01 SITE EXAMINATION

- A. The site is currently unoccupied and may be viewed at any time.

4.02 PREBID CONFERENCE

- A. A bidders conference has been scheduled for 2:00 p.m. local time on Thursday, the 11th day of June 2026 as a virtual teleconference:
- a. Join Zoom Meeting:
<https://us05web.zoom.us/j/83452282722?pwd=99rcHSmlBDeZ6xYXkqefumn0HOSwgl.1>
 - b. Meeting chat link
<https://us05web.zoom.us/jc/83452282722>
 - c. Meeting ID: 834 5228 2722
 - d. Passcode: 113794
 - e. One tap mobile -
+13017158592,,83452282722#,,,,*113794# US (Washington DC)
+13052241968,,83452282722#,,,,*113794# US
 - f. Join by SIP - • 83452282722@zoomcrc.com
 - g. Join Instructions:
<https://us05web.zoom.us/join/83452282722?signature=qNQdDpt4pmBa1AvNLhTLLqEaw1cU4291PYVyPwwc0AY>
- B. All general contract and subcontract bidders and suppliers are invited.
- C. Representatives of Architect and Engineers will be in attendance.
- D. Summarized minutes of this meeting will be circulated to all known bidders. 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 EVIDENCE OF QUALIFICATIONS

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

5.02 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Provide Proposed Subcontractor Form with Bid. See Section 00 43 36.
- B. Owner reserves the right to reject a proposed supplier for reasonable cause.
- C. Refer to General Conditions.

BID SUBMISSION

6.01 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.
- B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.
- C. Improperly completed information, irregularities in security deposit, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.
- D. An abstract summary of submitted bids will be made available to all bidders following bid opening.

6.02 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Owner, be declared unacceptable.
- C. Failure to provide security deposit, bonding or insurance requirements will invalidate the bid.

BID ENCLOSURES/REQUIREMENTS

7.01 SECURITY DEPOSIT

- A. Bids shall be accompanied by a security deposit as follows:
 - 1. Bid Bond of a sum no less than 5 percent of the Bid Amount on AIA A310 Bid Bond Form.
- B. Endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.
- C. The security deposit will be returned after delivery to the Owner of the required Performance and Payment Bond(s) by the accepted bidder.
- D. Include the cost of bid security in the Bid Amount.
- E. After a bid has been accepted, all securities will be returned to the respective bidders .
- F. If no contract is awarded, all security deposits will be returned.

7.02 PERFORMANCE ASSURANCE

- A. Include the cost of Performance and Payment Bonds in the Bid Amount and identify the cost on the Bid Form.
- B. Accepted Bidder: Provide a Performance and Payment bond as follows:
 - 1. Provide a 100 percent Performance Bond on AIA A312, or standard surety form.
 - 2. Provide a 100 percent Payment Bond on AIA A311, or standard surety form.

7.03 INSURANCE

- A. Provide an executed "Undertaking of Insurance" on a standard form provided by the insurance company stating their intention to provide insurance to the bidder in accordance with the insurance requirements of Contract Documents.
 - 1. Upon request by the Owner, provide Certificates of Insurance for all subcontractors and sub-sub contractors who perform work or services pursuant to the provisions of this contract.

7.04 BID FORM REQUIREMENTS

- A. Complete all requested information in the Bid Form and Appendices.
- B. Refer to the Bid Form for information regarding taxes.

7.05 ADDITIONAL BID INFORMATION

- A. The Contractor shall file for the building permit.
- B. Submit the following Supplements concurrent with bid submission:
 - 1. Document 00 43 36 - Proposed Subcontractors Form: Include the names of all Subcontractors and the portions of the Work they will perform.

7.06 SELECTION AND AWARD OF ALTERNATES

- A. Indicate variation of bid price for Alternates listed on the Bid Form. Unless otherwise indicated, indicate Alternates as a difference in bid price by adding to or deducting from the base bid price.
- B. Bids will be evaluated on the base bid price. After determination of a successful bidder, consideration will be given to Alternates and bid price adjustments.

OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

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

8.02 ACCEPTANCE OF OFFER

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

END OF SECTION

**SECTION 00 41 00
BID FORM**

THE PROJECT AND THE PARTIES

1.01 TO:

- A. Lakes Regional Healthcare (Owner)
2323 US-71 N
Spirit Lake, IA 51360

1.02 RECEIVED BY:

- A. Gary Van Wettering
Lakes Regional Healthcare
2323 US-71 N
Spirit Lake, IA 51360
Phone: 712-336-8782
Email: Gary.vanwettering@lakeshealth.org

1.03 FOR:

- A. Project: LRH - Pre-Engineered Building
B. Unison Design Studio Project No. 26022

1.04 DATE: _____ (BIDDER TO ENTER DATE)

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

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

1.06 OFFER

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

1.07 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. Commence work as agreed upon with the Owner after written Notice to Proceed of this bid, estimated to be on or near June 24, 2026.

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

1.08 CONTRACT TIME

- A. If this Bid is accepted, we will:
- B. Commence work on or around June 24, 2026, 2026.
- C. Substantially complete the Work on or before September 30, 2026.

1.09 ALTERNATES - SEE SECTION 01 23 00

- A. Alternates are identified by number and describe the basic changes to be incorporated into the Work only when that Alternate is made a part of the Work by specific provisions in the Owner-Contractor Agreement. Bidder, in submitting his bid proposal, shall include, in addition to his base bid, the following alternates. The numerical order of listing these alternates does not necessarily imply their priority. The Owner may decide to use any one or more of all the items. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate and to provide the complete construction required by the Contract Documents.
- B. Alternates identified on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
- C. Bidder, in submitting his bid proposal, shall include, in addition to his base bid, the following alternates:
 - 1. **ALTERNATE NO. 01:** Ceiling Fans
ADD or DEDUCT the Sum of : _____ DOLLARS
(\$ _____)
 - 2. **ALTERNATE NO. 02:** East Parking Expansion
ADD or DEDUCT the Sum of : _____ DOLLARS
(\$ _____)

1.10 ADDENDA

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

1.11 BID FORM SUPPLEMENTS

- A. The following Supplements are attached to this Bid Form and are considered an integral part of this Bid Form:
 - 1. Document 00 43 36 - Proposed Subcontractors Form: Include the names of Subcontractors and the portions of the Work they will perform.

1.12 BID FORM SIGNATURE(S)

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

B. _____
(Authorized signing officer, Title)

END OF SECTION

**SECTION 00 43 36
PROPOSED SUBCONTRACTORS FORM**

PARTICULARS

- 1.01 HEREWITH IS THE LIST OF SUBCONTRACTORS REFERENCED IN THE BID SUBMITTED BY:
1.02 (BIDDER) _____
1.03 TO (OWNER): LAKES REGIONAL HEALTHCARE
1.04 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.
1.05 THE FOLLOWING WORK WILL BE PERFORMED (OR PROVIDED) BY SUBCONTRACTORS
AND COORDINATED BY US:

LIST OF SUBCONTRACTORS

WORK SUBJECT	SUBCONTRACTOR NAME
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

END OF SECTION

**SECTION 00 50 00
CONTRACTING FORMS AND SUPPLEMENTS**

PART 1 GENERAL

**1.01 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL
COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.**

1.02 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. The Agreement is based on AIA A101.
- B. The General Conditions form is AIA A201.
 - 1. See Section 007200 for sample.

1.03 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. Clarification and Modification Forms:
 - 1. Architect's Supplemental Instructions Form: AIA G710.
 - 2. Construction Change Directive Form: AIA G714.
 - 3. Change Order Form: AIA G701.
- E. Closeout Forms:
 - 1. Certificate of Substantial Completion Form: AIA G704.

1.04 REFERENCE STANDARDS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 00 72 00
GENERAL CONDITIONS**

PART 1 - GENERAL

1.01 FORM OF GENERAL CONDITIONS

A. The General Conditions applicable to this contract is attached following this page.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

DRAFT AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

<>

THE OWNER:

(Name, legal status and address)

<

THE ARCHITECT:

(Name, legal status and address)

< >< >

< >

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ADDITIONS AND DELETIONS:

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

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

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

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

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

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

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.11 Documents and Samples at the Site

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

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

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

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

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

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

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

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

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

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

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

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

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

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

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

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

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

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

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

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

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

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

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

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

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

§11.5 Adjustment and Settlement of Insured Loss

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

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

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

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

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

§ 15.2 Initial Decision

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

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

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

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

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

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

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

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

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

§ 15.3 Mediation

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

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

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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



SECTION 01 10 00 SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: LRH - Pre-Engineered Building.
- B. Owner's Name: Lakes Regional Healthcare.
- C. Architect's Name: Unison Design Studio.
 - 1. Project Number: 25006
- D. This project consists of a 48' by 60' pre-engineered wood-framed building, with an interior office and restroom.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 50 00 - Contracting Forms and Supplements.

1.03 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner after Date of Substantial Completion. Some items include:
 - 1. Movable furniture, fixtures and equipment.
- B. Owner will supply and install the following:
 - 1. Toilet accessories as indicated as OFOI in Section 102800.
- C. Owner will supply the following for installation by Contractor:
 - 1. Toilet accessories as indicated as OFCI in Section 102800.

1.04 OWNER OCCUPANCY

- A. Owner intends to occupy the Project by the date stated in the Agreement as the contract completion date.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:
 - 1. Work by Others.
 - 2. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Time Restrictions:
 - 1. Limit conduct of especially noisy, malodorous, and dusty exterior work to after business hours.
- E. Utility Outages and Shutdown:
 - 1. Prevent accidental disruption of utility services to other facilities.

1.06 DEFINITIONS AND EXPLANATIONS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Change procedures.

1.02 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- E. Execute certification by signature of authorized officer.
- F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- H. Submit one electronic and three hard-copies of each Application for Payment.
- I. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 30 00.
 - 2. Construction progress schedule, revised and current as specified in Section 01 30 00.
 - 3. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
 - 4. Affidavits attesting to off-site stored products.
- J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.04 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.

- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 60 00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 2. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 - 3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

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

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 23 00
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.
- B. Agreement Form: Incorporating monetary value of accepted Alternates.

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.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 01: Ceiling Fans
 - 1. Base Bid: No ceiling fans.
 - 2. Alternate Item: Provide and install ceiling fans as indicated on MEPT drawings.
- B. Alternate No. 02: East Parking Expansion
 - 1. Base bid: Four (4) parking stall and associated drive aisles
 - 2. Alternate item:
 - a. Provide and install an additional four (4) parking stalls and associated drive aisles east of the structure.
 - b. Provide and install an additional two (2) Type S1 light fixtures and associated conduit and wire on east face of the structure. Extend control from other exterior lighting fixtures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: General product requirements.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

1.04 PROJECT COORDINATOR

- A. Project Coordinator: General Contractor.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site and building access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for Interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. The web-based software will provide status logs, reports, searching and automated notifications.
 - 2. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 3. Contractor and Architect are required to use this service.
 - 4. It is Contractor's responsibility to submit documents in allowable format.
 - 5. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 - 6. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 7. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 8. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: The selected service is:
 - 1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
 - 2. Newforma ConstructEx: www.newforma.com/our-solutions/constructex/#sle.
 - 3. Procore.
- D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 RELEASE OF ELECTRONIC DOCUMENTS (CAD/BIM FILES)

- A. Contractors may request plans for their use/benefit for assistance in preparing submittals or for use in construction.
 - 1. The Revit model will be provided at no charge.
 - 2. If CAD files, contractor shall identify specific sheets to be produced as files.
 - 3. A signed release form is required.

3.03 PRECONSTRUCTION MEETING

- A. Project Coordinator will schedule a virtual meeting after Notice of Award.
- B. Virtual Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Major subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.

2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Submission of initial Submittal schedule.
 6. Designation of personnel representing the parties to Contract, the Owner's Representative and Architect.
 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 8. 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.
1. Minutes will be distributed through email or Web-based project management software system.

3.04 PROGRESS MEETINGS

- A. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect, at frequency per Owner-Architect agreement.
 4. Contractor's superintendent.
 5. Additional consultants, subcontractors, suppliers and product representatives as appropriate to agenda topics for each meeting
- C. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to work.
- D. Project Coordinator will record minutes and distribute copies within seven days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.
1. Minutes will be distributed through email or Web based project management software system.

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 30 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.

3.06 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. List of separate contractors at Project site.
 5. Approximate count of personnel at Project site.
 - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
 6. Major equipment at Project site.
 7. Material deliveries.
 8. Safety, environmental, or industrial relations incidents.
 9. Meetings and significant decisions.
 10. Unusual events (submit a separate special report).
 11. 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.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Directives and requests of authority having jurisdiction (AHJ).
 15. Testing and/or inspections performed.
 16. List of verbal instruction given by Owner and/or Architect.

3.07 COORDINATION DRAWINGS

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

3.08 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.

- b. Do not forward requests which solely require internal coordination between subcontractors.
- 2. Prepare using software provided by the Electronic Document Submittal Service.
- 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 - 3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
 - 5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.
 5. RFI responses that modify contract documents should come with revised drawing sheets or specification sections.

3.09 SUBMITTAL SCHEDULE

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

3.10 SUBMITTALS FOR REVIEW

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

3.11 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Sustainability design submittals and reports.
 3. Certificates.
 4. Test reports.
 5. Inspection reports.
 6. Manufacturer's instructions.
 7. Manufacturer's field reports.
 8. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

- C. Daily Log: Submit to Owner through Architect two (2) copies of Contractor's daily log indicating all personal on-site including names and time on site. Submit at maximum of monthly intervals at progress meetings and immediately upon request of Owner.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

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

3.14 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 2. Transmit using approved form.
 - a. Use form generated by Electronic Document Submittal Service software.
 - 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 5. 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.
 - 6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 - 7. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 - 8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.

9. Provide space for Contractor and Architect review stamps.
 10. When revised for resubmission, identify all changes made since previous submission.
 11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 13. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.15 SUBMITTAL REVIEW

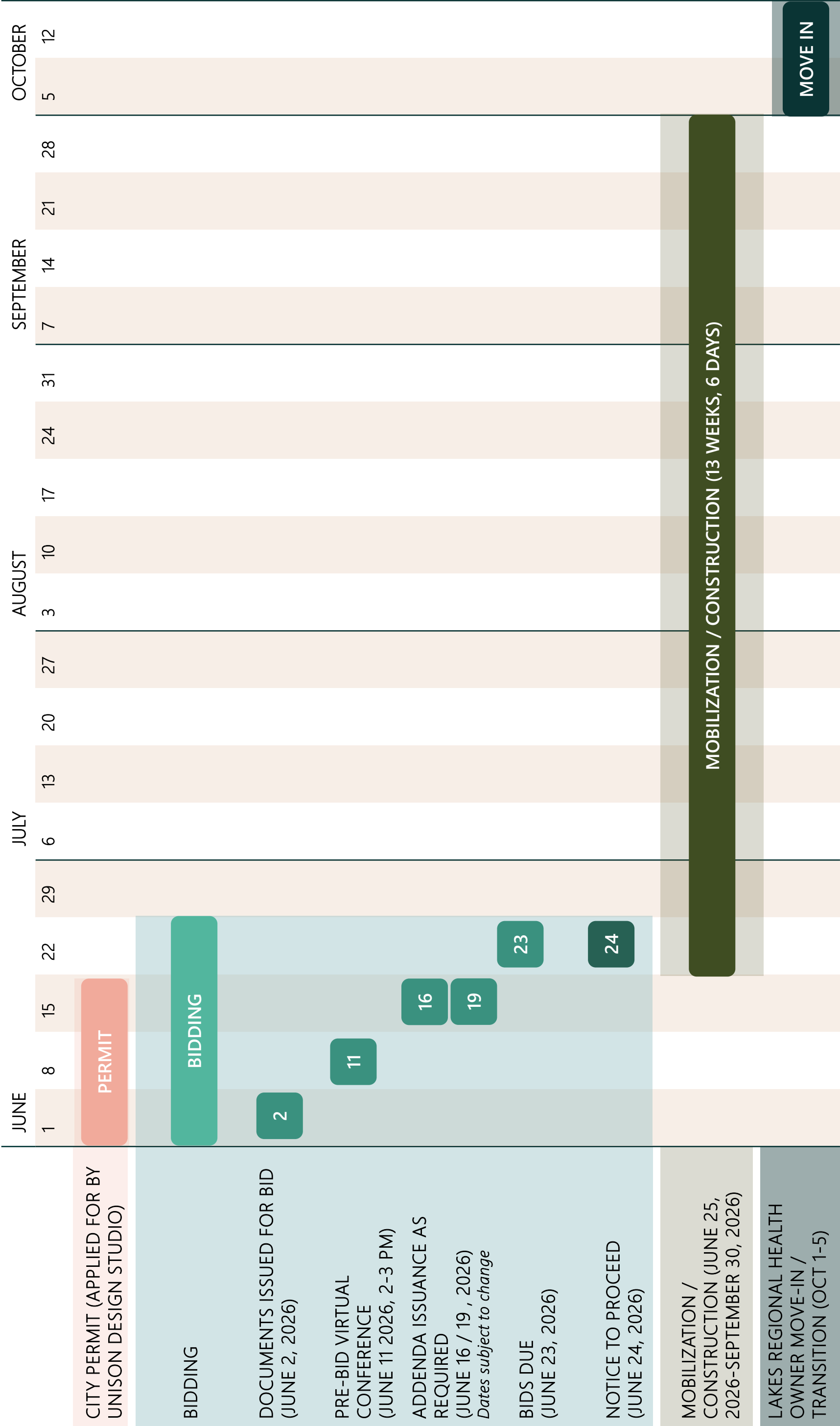
- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, 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.
 - 2) Non-responsive resubmittals may be rejected.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

LRH Pre-Engineered Building Schedule

5/28/2026



**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 DEFINITIONS

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

1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary bracing.
 - 4. Temporary foundation underpinning.
 - 5. Temporary stairs or steps required for construction access only.
 - 6. Temporary hoist(s) and rigging.
 - 7. Investigation of soil conditions to support construction equipment.

1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1. Structural Design of Stairs: As described in Section 05 51 00 - Metal Stairs.
2. Structural Design of Suspension System: Include loads at points of attachment to building structure, physical characteristics, and resulting dimensional limitations as described in Section 10 22 39 - Folding Panel Partitions.
3. Structural Design: Include loads at points of attachment to building structure, physical characteristics, and resulting dimensional limitations as described in Section 10 22 41 - Operable Glass Partitions.
4. Design of Structural Components: As described in Section 14 24 00 - Hydraulic Elevators.
5. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 21 13 00 - Fire-Suppression Sprinkler Systems.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 2. Include required product data and shop drawings.
 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.06 REFERENCES AND STANDARDS

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

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing and inspection.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. See Section 01 45 33 - Code-Required Special Inspections and Procedures for additional information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Notify Architect and Architect's Consultant fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
- G. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- I. Where possible salvage and recycle the demolished mock-up materials.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

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

- b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
- 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

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

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing services incidental to special inspections.
- B. Submittals.
- C. Fabricators' field services.

1.02 DEFINITIONS

- A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. NIST: National Institute of Standards and Technology.
- D. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
 - 1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

- A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- B. IAS AC89 - Accreditation Criteria for Testing Laboratories.
- C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291.
- D. ICC (IBC) - International Building Code.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Testing and Special Inspection Agency Qualifications: Prior to start of work, Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Testing and Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.

- h. Date of special inspection.
- i. Results of special inspection.
- j. Compliance with contract documents.

D. Fabricator's Inspection Reports: When required by AHJ, submit reports to Architect and AHJ.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

- A. Owner or Architect to employ services of Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by building code.
- B. Special Inspection Agency may delegate to independent testing agency to perform testing and sampling associated with special inspections and required by building code.
- C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

- A. Owner or Architect may employ services of independent testing agency to perform additional testing and sampling required by contract documents or associated with special inspections but not required by building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS AND TESTING

- A. The Code requires special inspections and testing of certain materials, components, assemblies, and connections used in constructing the project. Special inspections and testing will be performed in accordance with the Code.
- B. Special inspections and testing will be performed in accordance with the Code for the following materials and project components:
 - 1. Steel.
 - 2. Concrete.
 - 3. Masonry.
 - 4. Soils.
 - 5. Fire-resistant penetrations and joints.

3.02 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 4. Ascertain compliance of materials and products with requirements of Contract Documents.

5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.03 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
1. Test samples submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the work.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.04 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.

5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.05 FABRICATORS' FIELD SERVICES

- A. When required by AHJ or specified in individual specification sections, require fabricators to provide qualified staff personnel to observe site conditions, installation conditions, quality of workmanship, and start-up of equipment and systems and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

**SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 DEWATERING

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

1.03 TEMPORARY UTILITIES

- A. Owner will provide the following:
 - 1. Electrical power, consisting of connection to existing facilities.
 - 2. Water supply, consisting of connection to existing facilities.
 - 3. Gas supply, consisting of connection to existing facilities.
- B. Provide and pay for all lighting, heating and cooling, and ventilation required for construction purposes.
- C. New permanent facilities may be used.
- D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

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

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. New permanent facilities may not be used during construction operations.
- D. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 EXTERIOR ENCLOSURES

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

1.09 SECURITY

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

1.10 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Designated existing on-site roads may be used for construction traffic.
- F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- G. Provide two parking spaces for guest use.

1.11 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT IDENTIFICATION

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

1.13 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

- C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 4 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 60 00
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transportation, handling, storage and protection.
- B. Product option requirements.
- C. Substitution limitations.
- D. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 60 10 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- C. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

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

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.
 - 3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

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

3.02 TRANSPORTATION AND HANDLING

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

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

**SECTION 01 60 10
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

1.03 DEFINITIONS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

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

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
1. Section 00 21 13 - Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

- B. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing the form in Section 01 60 10.01 - Substitution Request Form ; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing the form in Section 00 43 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
 - b. Other construction by Owner.
 - c. Other unanticipated project considerations.
- D. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

3.04 RESOLUTION

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

3.05 ACCEPTANCE

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

3.06 CLOSEOUT ACTIVITIES

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

END OF SECTION

**SECTION 01 60 10.01
SUBSTITUTION REQUEST FORM**

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

PROJECT TITLE _____ PROJECT NO. _____

DRAWING NO. _____ DRAWING TITLE _____

SPEC. SECTION SPEC. TITLE PARAGRAPH SPECIFIED ITEM

Proposed Substitution: _____

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

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

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

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

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

Submitted by:

Signature

Firm

Address

Telephone

Email

Date

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

Fill in Blanks Below:

Does the substitution affect dimensions shown on Drawings? Yes No

If yes, clearly indicate changes:

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

If no, fully explain:

Pre-Engineered Building
Lakes Regional Healthcare
Unison Design Studio #26022

01 60 10.01
SUBSTITUTION REQUEST FORM
Page 1 of 2

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

What effect does substitution have on construction schedule?

Manufacturer's warranties of the proposed and specified items are:
_____ Same _____ Different (Explain on Attachment)

Reason for Request:

Itemized comparison of specified item(s) with the proposed substitution.
List significant variations:

Accurate cost data comparing proposed substitution with product specified:

Designation of maintenance services and sources:

(ATTACH ADDITIONAL SHEETS IF REQUIRED)

For Use by Design Professional:

_____ Recommended _____ Recommended as Noted
_____ Not Recommended _____ Received Too Late

Signed By _____

Date _____

For Use by Owner's Representative or Owner:

_____ Approved _____ Approved as Noted
_____ Not Approved _____ Approved Too Late

Signed By _____

Date _____

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- C. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.
- D. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Effect on work of Owner or separate Contractor.
 - f. Written permission of affected separate Contractor.
 - g. Date and time work will be executed.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.06 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers, pneumatic hammers, air-operated nail guns, and diesel engines.
- E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

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

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.
 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 1. Verify that construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 1. Remove items indicated on drawings.
 2. Relocate items indicated on drawings.
 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 10 00 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 2. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.

- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

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

3.09 PROTECTION OF EXISTING AND INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.

- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

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

3.12 ADJUSTING

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

3.13 FINAL CLEANING

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

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

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

3.15 MAINTENANCE

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

END OF SECTION

**SECTION 01 78 00
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit electronic set of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

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

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

3.02 OPERATION AND MAINTENANCE DATA

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

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

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into pdf format for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed/bookmarked divider for each system.
- C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- E. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- F. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- G. Drawings: Provide pdf file with bookmarked pages.
- H. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.

- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each product type.
- B. Design Mixtures: For each concrete mixture
- C. Shop Drawings:
 - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each product, signed by manufacturers.
- B. Material Test Reports: For each product, from a qualified testing agency:
- C. Preconstruction Test Reports: For each mix design.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.
- F. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301.

1.09 STEEL REINFORCEMENT

- A. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- B. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- C. Galvanized Reinforcing Bars:
 - 1. Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
- D. Epoxy-Coated Reinforcing Bars:
 - 1. Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
 - 2. Epoxy Coating: ASTM A775/A775M or ASTM A934/A934M with less than 2 percent damaged coating in each 12-inch bar length.
- E. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- G. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
- H. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, steel.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.02 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, Type IL.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C595/C595M, cement.
- B. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
 - 2. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.03 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Barrier One, Inc.
 - b. Barrier-Bac; Inteplast Group.
 - c. Fortifiber Building Systems Group.
 - d. ISI Building Products.
 - e. Poly-America, L.P.
 - f. Raven Industries, Inc.
 - g. Reef Industries, Inc.
 - h. Basis of Design: Stego Industries, LLC. (LEED: HPD+)
 - i. Tex-Trude.
 - j. Trim-A-Slab.
 - k. W.R. Meadows, Inc.

B. Reinforcing Materials

1. Provide rebar chairs that will not puncture bentonite panels or provide additional panel material at chair locations.

2.04 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Floor Slab Protective Covering: Eight-foot-wide cellulose fabric.

2.05 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.
 3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.

4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.06 CONCRETE MIXTURES

A. Normal-weight concrete.

1. Minimum Compressive Strength: As indicated at 28 days.
2. Maximum w/cm: 0.50.
3. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
4. Air Content:
 - a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery.

2.07 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

PART 3 - EXECUTION

3.01 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.02 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- E. Doweled Joints:
 - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.03 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

3.04 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
 - 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
- B. Related Unformed Surfaces:
 - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.05 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish:
 - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 - 2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
 - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 4. Do not add water to concrete surface.
 - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 - 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 7. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

3.06 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
 - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 - 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
 - 1. Cast-in inserts and accessories, as shown on Drawings.
 - 2. Screed, tamp, and trowel finish concrete surfaces.

3.07 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
 - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 - 3. If forms remain during curing period, moist cure after loosening forms.

4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
 1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.

3.08 TOLERANCES

- A. Conform to ACI 117.

3.09 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C143/C143M:
 3. Slump Flow: ASTM C1611/C1611M:
 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 5. Concrete Temperature: ASTM C1064/C1064M:
 6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 7. Compression Test Specimens: ASTM C31/C31M:
 8. Compressive-Strength Tests: ASTM C39/C39M.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests:

- a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.10 PROTECTION

- A. Protect concrete surfaces as follows:
 - 1. Protect from petroleum stains.
 - 2. Diaper hydraulic equipment used over concrete surfaces.
 - 3. Prohibit vehicles from interior concrete slabs.
 - 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 - 5. Prohibit placement of steel items on concrete surfaces.
 - 6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION

**SECTION 03 35 11
CONCRETE FLOOR FINISHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid densifiers and hardeners (CONC1).

1.02 RELATED REQUIREMENTS

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

1.03 ADMINISTRATIVE REQUIREMENTS

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

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
- D. Maintenance and Cleaning: Provide manufacturer's printed maintenance and cleaning instructions and recommendations to Owner for all concrete floor sealer finishes.
 - 1. Ensure that Owner has received a list of cleaning materials that are known to be acceptable for cleaning and another list of materials known to be deleterious to the finished concrete floors.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 5 years of documented experience.
- B. Flooring supplier shall approve concrete mix additives, topical treatments and curing methods prior to concrete placement.
- C. Applicator Qualifications: Company specializing in performing the work of this section and approved by manufacturer of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Densifier and Hardener:
 - 1. Use at the following locations: all areas of exposed concrete.

2.02 DENSIFIERS AND HARDENERS

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

1. Composition: Lithium silicate.
 - a. Products:
 - 1) Concrete Sealers USA; PS103: www.concretesealersusa.com/#sle.
 - 2) Euclid Chemical Company; ULTRASIL LI+: www.euclidchemical.com/#sle.
 - 3) Kaufman Products Inc; SureHard LS: www.kaufmanproducts.net/#sle.
 - 4) L&M Construction Chemicals, Inc; LiON HARD: www.lmcc.com/#sle.
 - 5) Nox-Crete Products Group; Duro-Nox LS: www.nox-crete.com.
 - 6) PROSOCO, Inc; Consolideck LS/CS: www.prosoco.com/consolideck/#sle.
 - 7) SpecChem, LLC; LithSeal SC: www.specchemllc.com/#sle.
 - 8) W. R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com/#sle.
 - 9) Substitutions: See Section 01 60 00 - Product Requirements.
2. Composition: Sodium silicate, with siliconate.
 - a. Products:
 - 1) Concrete Sealers USA; PS107: www.concretesealersusa.com/#sle.
 - 2) Curecrete Distribution, Inc; Ashford Formula: www.curecrete.com/#sle.
 - 3) Euclid Chemical Company; EUCO DIAMOND HARD: www.euclidchemical.com/#sle.
 - 4) Kaufman Products Inc; SureHard: www.kaufmanproducts.net/#sle.
 - 5) L&M Construction Chemicals, Inc; SEAL HARD: www.lmcc.com/#sle.
 - 6) Nox-Crete Inc; Duro-Nox: www.nox-crete.com/#sle.
 - 7) SpecChem, LLC; SpecHard: www.specchemllc.com/#sle.
 - 8) W. R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com/#sle.
 - 9) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 GENERAL

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

3.03 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 PROTECTION

- A. Protect installed coatings from subsequent construction operations.
- B. Do not permit traffic over unprotected floor surface.

- C. Take appropriate precautions to prevent staining of concrete floor surfaces. Since no satisfactory procedures are available to remove petroleum and rust stains from concrete, comply with the following:
1. Cover and protect floor surfaces from damage and staining during the construction period.
 2. Ensure that construction equipment, particularly components that may drip oil, hydraulic fluid, and other liquids, are provided with suitable diaper.
 3. In addition to diaper, equipment such as pipe cutting machines shall be placed on suitable drop cloths.
 4. Do not permit temporary placement and storage of steel members on concrete slabs.

END OF SECTION

**SECTION 04 26 13
MASONRY VENEER**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clay Facing Brick.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Installation of lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 74 19 - Construction Waste Management and Disposal.
- B. Section 04 72 00 - Cast Stone Masonry
- C. Section 07 27 00 - Air Barriers: Coordination of brick ties.
- D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- E. ASTM C150/C150M - Standard Specification for Portland Cement.
- F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- G. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- J. ASTM C476 - Standard Specification for Grout for Masonry.
- K. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
- L. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.
- M. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls.
- N. BIA Technical Notes No. 46 - Maintenance of Brick Masonry.
- O. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and accessories.
- C. Masonry restoration work shall comply with TMS 402 and TMS 602, except where exceeded by requirements of the contract documents.

- D. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA, or applicable building code, whichever is more stringent.
- E. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
 - 1. Strap samples with approved mortar.
- F. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage, flashings and accessory locations.
- G. Steel Reinforcement Shop Drawings: Prepare Shop Drawings showing details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement".
 - 1. Include material, grade, bar schedules, tie and/or stirrup spacing, splices, bent bar diagrams, and other arrangements and assemblies required for fabrication and placement of reinforcement for masonry work.
 - 2. Show all walls in plan and elevation.
- H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. See Section 014533 for testing and inspection requirements. Testing and inspection shall comply with the requirements of the governing edition of the IBC.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- E. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- F. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Handle and store masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos.
- D. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- E. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.07 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

PART 2 PRODUCTS

2.01 UNIT MASONRY - GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.02 BRICK UNITS

- A. Manufacturers:
 - 1. Belden Brick; www.beldenbrick.com
 - 2. Endicott Clay Products Co: www.endicott.com.
 - 3. **BASIS OF DESIGN:** Glen-Gery Brick Center
 - 4. Sioux City Brick
 - 5. United Brick, A Division of Sioux City Brick; www.united-brick.com
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Facing Brick: ASTM C216, Type FBX, Grade SW.
 - 1. Color and Texture:
 - a. White Plains Velour
 - 2. Size: Modular.
 - 3. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 - 4. Colored Mortar:
 - a. Color: As selected by Architect to match brick color.

2.03 MORTAR AND GROUT MATERIALS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

1. Not more than 0.60 percent alkali.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
 1. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 2. White-Mortar Aggregates: Natural white sand or crushed white stone.
 3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- E. Grout Aggregate: ASTM C404.
- F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 1. Color(s): As selected by Architect from manufacturer's full range.
 2. Manufacturers:
 - a. Davis Colors, a division of Venator Materials PLC: www.daviscolors.com/#sle.
 - b. Lambert Corporation: www.lambertusa.com/#sle.
 - c. Solomon Colors, Inc: www.solomoncolors.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Water: Clean and potable.
- H. DO NOT use calcium chloride in mortar or grout.
- I. 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. Manufacturers:
 - a. Amerimix, an Oldcastle brand; AMX 405C: www.amerimix.com/#sle.
 - b. Cemex; USA; Masonry Mortar; www.cemexusa.com.
 - c. SpecMix; Portland, Lime and Sand Mortar; www.specmix.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 1. Blok-Lok Limited: www.blok-lok.com/#sle.
 2. Heckmann Building Products, Inc.: www.heckmannbuildingprods.com.
 3. Hohmann & Barnard, Inc: www.h-b.com/#sle.
 4. WIRE-BOND www.wirebond.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength, deformed billet bars; galvanized.
- C. Joint Reinforcement Type: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Prefabricated Corners and Tees: Standards of joint reinforcement manufacturer to match adjacent reinforcing type.
- E. 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. Width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
 3. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 4. Vertical adjustment: Not less than 2 inches.

5. Insulation Clips: Provide pintle ends designed to secure insulation against outer face of inner wythe of masonry.
6. Accommodate thickness of cavity wall insulation.
7. Basis of Design:
 - a. Stud Backup: WIRE-BOND: RJ-711 Adjustable Veneer Anchor (Hook & Eye)
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MISCELLANEOUS ANCHORS

- A. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
 1. Structural Applications:
 - a. As indicated.
 2. Non-Structural Applications:
 - a. Acceptable Manufacturers and products:
 - 1) Hilti Fastening Systems
 - (a) Kwik Bolt III Expansion Anchor
 - (b) HIT HY 70
 - 2) ITW Red Head:
 - (a) Trubolt Wedge Anchor
 - (b) Epcon C6 Adhesive.
 - 3) Powers Fastening Inc:
 - (a) Power-Stud Expansion Anchor
 - (b) PE1000+ Adhesive.
 - 4) Or approved equivalent.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.

2.06 FLASHINGS

- A. Verify compatibility of masonry flashing and associated materials with weather membrane specified in Section 07 27 00.
- B. 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.
 1. Puncture Resistance: 2,500 psi per ASTM E154.
 2. Manufacturers:
 - a. Hohmann & Barnard, Inc; Mighty-Flash Stainless Flashing: www.h-b.com/#sle.
 - b. WIRE-BOND: www.wirebond.com/#sle.
 - c. York Flashings; Multi-Flash SS: www.yorkflashings.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Stainless Steel/Polymer Fabric Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on inward facing side to a sheet of polymer fabric that has a clear adhesive with a removable release liner.
 1. Use with manufacturer's standard, self-adhering, stainless steel lap tape.
 2. Puncture Resistance: 2,500 psi per ASTM E154.
 3. Manufacturers:
 - a. Hohmann & Barnard, Inc; Mighty Flash SA: www.h-b.com/#sle.
 - b. York Manufacturing, Inc; York 304.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- D. 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.
 1. Manufacturers, Modified Polyether Products:
 - a. Hohmann and Barnard; HB Sealant; www.h-b.com..
 - b. Mortar Net Solutions: www.mortarnet.com/#sle.
 - c. York Manufacturing, Inc; UniverSeal US-100 Liquid Tape: www.yorkmfg.com/#sle.

- d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Termination Bars: Stainless steel; pre-drilled, compatible with membrane and adhesives.
- F. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
 - 1. Provide prefabricated inside and outside corners.
 - 2. Manufacturers:
 - a. Hohmann & Barnard, Inc; DP-FTS: www.h-b.com/#sle.
 - b. Mortar Net Solutions; Metal Drip Edges: www.mortarnet.com/#sle.
 - c. York Manufacturing, Inc: www.yorkmfg.com/#sle.
 - d. Wirebond: #4165 Drip Edge Flashing; www.wirebond.com
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.07 ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. Any acceptable manufacturer of joint reinforcement and anchors listed above.
 - 2. Advanced Building Products, Inc.: www.advancedbuildingproducts.com.
 - 3. CavClear/Archovations, Inc.: www.cavclear.com.
 - 4. Mortar Net Solutions: www.mortarnet.com.
 - 5. Masonry Technology Incorporated: www.mtidry.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers:
 - a. Blok-Lok Limited: www.blok-lok.com/#sle.
 - b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
 - c. WIRE-BOND; 2901 or 2902 Rubber Control Joints: www.wirebond.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- D. Cavity Weep/Vents: Rectangular shaped, UV-stable, high impact polystyrene sheets, sized for mortar joints, formed with corrugations.
 - 1. Color: as selected by Architect from manufacturer's full range (to match mortar color).
 - 2. Manufacturers:
 - a. Heckman Building Products: No. 85 Cell Vent
 - b. Hohmann & Barnard: Quadro-Vent
 - c. WireBond: Cell Vents
 - d. Substitutions: See Section 016000 - Product Requirements.
- E. 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. Not required with Stainless Steel/Polymer Fabric Drainage Plane Flashing
 - 2. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers:
 - 1) Advanced Building Products, Inc; Mortar Break DT: www.advancedbuildingproducts.com/#sle.
 - 2) CavClear/Archovations, Inc: www.cavclear.com/#sle.
 - 3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.

- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
 - 1. Acceptable Manufacturer and Product: As expressly recommended and approved for intended use by manufacturers of brick masonry units and mortar being cleaned.
 - 2. Manufacturer's proprietary standard-strength general purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction-related stains from brick masonry unit and mortar surfaces without discoloring or damaging masonry work or adjacent materials.
 - a. Suitable for conditions at Project Site, including, but not limited to, windows, doors, other wall elements, and adjacent walks or landscaping.
 - b. Cleaning Restrictions: The following methods are not permitted nor will they be allowed:
 - 1) Hydrochloric acid.
 - 2) Muriatic acid.
 - 3) Pressurized water blasting.
 - 4) Abrasive blasting.

2.08 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
 - 1. Masonry below grade and in contact with earth; Type S.
 - 2. Exterior, non-loadbearing masonry; Type N.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency as required to fill volumes completely for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
 - 1. Minimum compressive strength: 2000 psi, unless otherwise noted.
- D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- E. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.

3. Mortar Joints: Concave.

3.05 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 and smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weep/vents in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels, at bottom of walls, and below shelf angles and lintels and at top of walls.

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. 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.

3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Stud back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 2-2/3 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.09 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Terminate flashing up 8 inches minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.
 - 2. Anchor vertical leg of flashing into backing with a termination bar and sealant.
 - 3. Apply cap bead of sealant on top edge of self-adhered flashing.
- C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- D. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
- E. Extend flexible flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

- F. Support flexible flashings across gaps and openings.
- G. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.10 CONTROL AND EXPANSION JOINTS

- A. Install brick expansion joints where indicated on Drawings as "EJ", but not less than one for each 24 feet of wall length, at changes in veneer plane, at changes in veneer height, to restrict individual horizontal brick veneer panels to a height to length ratio of 1 to 4 maximum, unless otherwise justified by calculations.
- B. Locate brick expansion joints within 2 feet of each side of exterior corners and at inside corners, unless otherwise indicated on Drawings.
- C. Do not continue horizontal joint reinforcement through control or expansion joints.
- D. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.11 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, glazed frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.12 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.

3.13 CUTTING AND FITTING

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

3.14 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.

3.15 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- B. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- C. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
- D. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- E. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

- F. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

END OF SECTION

**SECTION 04 72 00
CAST STONE MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.
- B. Units required are:
 - 1. Exterior wall units, including sills.

1.02 RELATED REQUIREMENTS

- A. Section 04 26 13 - Masonry Veneer: Installation of cast stone in conjunction with masonry.
- B. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code for Structural Concrete—Code Requirements and Commentary.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- E. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- F. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
- G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- I. ASTM C150/C150M - Standard Specification for Portland Cement.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- K. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
- M. ASTM C1364 - Standard Specification for Architectural Cast Stone.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Mortar Color Selection Samples.
- E. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.
 - 1. Include samples with specified sealer applied to a half of the surface of a cast stone sample.
- F. Full-Size Samples, For Review:
 - 1. Basic Shapes: One of each.

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.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Cast Stone:
 - 1. Any current producer member of the Architectural Precast Association.
 - 2. Any current producer member of the Cast Stone Institute.
 - 3. American Artstone
 - 4. Big River Cast Stone: www.bigrivercaststone.com.
 - 5. Edwards Cast Stone Co: www.edwardscaststone.com
 - 6. MarcStone, LLC: www.marcstone.com.
 - 7. Midwest Cast Stone: www.midwestcaststone.com
 - 8. Rock Cast Architectural Series
 - 9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.
 - 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - 2. Absorption: Maximum of 6 percent by cold water method, maximum of 11 percent by boiling method; ASTM C 1195.
 - 3. Air Content: For wet cast product shall be 4 to 8 percent for units exposed to freeze-thaw environments, ASTM C173 or ASTM C 231.
 - 4. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 - 5. Linear Shrinkage: Maximum of 0.065 percent, ASTM C 426.
 - 6. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 - 7. Color: Selected by Architect from manufacturer's full range.
 - 8. 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.
 - 1. Pieces More than 12 inches in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.
 - 2. Provide stainless steel dowels, anchors, or threaded inserts cast into units as required to secure capstones to seatwall bond beam or CMU backup.

2.03 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Units: Type I or III, white or gray as required to match Architect 's sample.
 - 2. 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. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.
- E. Admixtures: ASTM C494/C494M.
- F. Water: Potable.
- G. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
 - 2. Epoxy coated in accordance with ASTM A775/A775M.
- H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
 - 1. Welded wire fabric reinforcing shall not be used in dry cast products.
- I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- J. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.
- K. Mortar: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.
- L. Flashings: As specified in Section 04 26 13 - Masonry Veneer.
- M. Sealant: As specified in Section 07 92 00 - Joint Sealants.
- N. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 26 13 .
- C. Mechanically anchor each cast stone unit.
 - 1. Add wall ties at locations where horizontal veneer masonry joints do not align with masonry back up joints. Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels.
- D. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 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. Sealant Joints: Install sealants as specified in Section 07 92 00 - Joint Sealants.
- C. 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. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 - 1. Wet surfaces with water before applying cleaner.
 - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 - 4. Do not use acidic cleaners.

3.06 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

**SECTION 05 50 00
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items, including:
 - 1. Bollards with bollard covers.
- B. Miscellaneous angles, channels, tubes, plates, brackets and fasteners, as required to complete the project, including but not limited to:
 - 1. Jamb angles and plates
 - 2. Slotted channel adjustable framing system.
 - 3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 09 91 23 - Interior Painting: Paint finish.
- C. Section 09 96 00 - High-Performance Coatings: Field finish, where indicated as "HPC".

1.03 REFERENCE STANDARDS

- A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- K. 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.
- L. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- N. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- O. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel.

- Q. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.
- R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
- S. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).
- T. SSPC-SP 2 - Hand Tool Cleaning.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on each prefabricated product to be used, including installation instructions.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.05 QUALITY ASSURANCE

- A. Design members and connections under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricate steel items in accordance with AISC "Steel Construction Manual."

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Stainless Steel, General: ASTM A666/A666M, Type 304.
- F. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- G. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- H. Slotted Channel Fittings: ASTM A1011/A1011M.
- I. Bolts, Nuts, and Washers: ASTM A307, Grade A, galvanized to ASTM A153/A153M where connecting galvanized components.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- M. Anchoring Devices:
 - 1. Anchor Rods: Anchor rods used with structural steel members shall be plain steel rods conforming to ASTM F1554 (Grade 36), complete with suitable nuts and washers, unless noted otherwise.
 - 2. Expansion Bolts: Expansion anchors shall consist of one-piece wedge type carbon steel anchor bolts with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633.
 - a. Structural Applications
 - 1) Acceptable products must have a valid and current ICC report, as listed at www.icc-es.org.

- b. Non-Structural Applications
 - 1) Acceptable Manufacturers and products: Hilti Fastening Systems- Kwik Bolt III Anchor; ITW Red Head Mechanical Anchoring Systems - Trubolt Wedge Anchor; Powers Fastening Inc - Power-Stud Anchor; (or approved equivalent)
 - 3. Epoxy Adhesive Anchoring System: Epoxy anchoring shall consist of a threaded rod and the epoxy adhesive cartridge.
 - a. Structural Applications
 - 1) Acceptable products must have a valid and current ICC report, as listed at www.icc-es.org.
 - b. Non-Structural Applications
 - 1) Acceptable Manufacturers and products: Hilti Fastening System - HIT RE 500; ITW Red Head Adhesive Anchoring Systems - Epcon C6 Adhesive; Powers Fastening Inc. - PE1000+; (or approved equivalent).
 - N. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 5,000 psi at 28 days.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds, where welding is indicated.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Welded Joints: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously where visible or where exposed to moisture, even if intermittent or stitch welds are structurally adequate, and to comply with the following:
 - 1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by continuous welds.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.03 FABRICATED ITEMS

- A. Bollards: Steel pipe, Schedule 40, 1/4" wall thickness, concrete filled, crowned steel plate cap, diameters as indicated; 48-inches tall and 42-inches into grade, unless otherwise indicated; zinc-rich primer for field finish.
 - 1. Bollard Sleeve/Visibility Cover: Provide manufacturer's thermoplastic 1/4 inch thick HDPE cover with UV inhibitors.
 - a. Size: height as indicated on drawings; coordinate sleeve diameter prior to production of bollard.
 - b. Sleeve Configuration: domed cap, smooth finish.
 - c. Color: as selected by Architect.
 - d. Manufacturers:
 - 1) IdealShield: www.idealshield.com
 - 2) Post Guard: www.postguard.com.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.

- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and other non-structural members; prime paint finish.
- C. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, polyester powder-coat finish.
 - 1. Product: System of channel members and bolted connections fabricated to support loads without welded connections.
 - 2. Fittings and accessories shall be fabricated from hot rolled, pickled and oiled steel plates meeting the requirements of ASTM A 575.
 - 3. Nuts and screws shall be Unified and American coarse screw thread meeting the requirements of ASTM A 576 GR1015 (nut), and ASTM A 307 and SAE J429 GR2 (screw); electro-galvanized (EG) coated to commercial standards meeting the requirements of ASTM B 633 Type III SC1 finish.
 - 4. Furnish in 10 foot minimum lengths when available.
 - 5. Finish:
 - a. Black Painted
 - b. Galvanized.
 - c. All miscellaneous accessories, brackets, and fittings shall match framing.
 - 6. Manufacturer:
 - a. Grainger or approved equal from
 - b. Unistrut Corporation: Unistrut
 - c. B-Line Systems, Inc. Powerstruct
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for exposed finish.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Examine substrates and site area for conditions that might prevent satisfactory installation.
- C. Verify that dimensions of supporting structure are within plus/minus 1/8 inch of dimensions shown on shop drawings.
- D. Verify that all adjacent painting, roofing, masonry work, and other work that might damage prefinished items has been completed prior to installation.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.
- C. Remove all mill scale, rust, grease, foreign matter and surface imperfections from steel components that will be painted to ensure a smooth, even appearance of finish.

3.03 INSTALLATION

- A. Install premanufactured items in accordance with manufacturer's installation instructions.
- B. Install items plumb and level, accurately fitted, free from distortion or defects.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Anchor units to structure as indicated on the drawings.
- E. Field weld components as indicated on shop drawings.
- F. Perform field welding in accordance with AWS D1.1/D1.1M.
- G. Obtain approval prior to site cutting or making adjustments not scheduled.
- H. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.
- I. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors. Grout voids as required to result in secure installation.
- J. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/8 inch per story or 10 feet, non-cumulative.
- B. Maximum Offset From True Alignment: 1/8 inch in 10 feet.
- C. Maximum Out-of-Position: 1/8 inch in 48 inches.

3.05 CLEANING

- A. Clean exterior surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.06 PROTECTION

- A. Protect items after installation to prevent damage due to other work until Date of Substantial Completion

END OF SECTION

SECTION 06 16 00 SHEATHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheathing:
 - 1. Wood-based.

1.02 RELATED REQUIREMENTS

- A. Section 07 27 00 - Air Barriers: Air barrier over sheathing.
- B. Section 13 34 00 - Pre-Engineered Building Systems: Primary and secondary framing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. 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.
- C. PS 2 - Performance Standard for Wood Structural Panels.
- D. PS 20 - American Softwood Lumber Standard.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on panel products.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Engineered wood products containing added urea-formaldehyde are not permitted.

2.02 CONSTRUCTION PANELS

- A. Wall Sheathing, For Exterior: PS 2 type.
 - 1. Bond Classification: Exposure 1.
 - 2. Grade: Structural I Sheathing.
 - 3. Span Rating: 36 inch.
 - 4. Performance Category: 3/4 PERF CAT
 - a. Verify with structural design of pre-engineering metal building.
 - 5. Edge Profile: Square edge.
- B. Wall Sheathing, For Interior: PS 2 type.
 - 1. Bond Classification: Exposure 1.
 - 2. Grade: Sheathing.
 - 3. Span Rating: 16.
 - 4. Performance Category: 1/2 PERF CAT
 - a. Verify exterior wall sheathing with structural design of pre-engineering metal building.
 - 5. Edge Profile: Square edge.

2.03 ACCESSORIES

- A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Screws: ASTM C1002; Type W, bugle head, self-piercing, tapping screws; length to penetrate wood members 5/8 inch minimum.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing, using screws.

3.03 TOLERANCES

- A. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.04 CLEANING

- A. Waste Disposal:
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 83 16
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels (FRP).
- B. Trim.

1.02 REFERENCE STANDARDS

- A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ISO 846 - Plastics - Evaluation of the Action of Microorganisms.
- G. ISO 2812-1 - Paints and Varnishes -- Determination of Resistance to Liquids -- Part 1: Immersion in Liquids Other than Water.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 8 by 8 inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels (FRP1):
 - 1. Crane Composites, Inc: www.cranecomposites.com/#sle.
 - 2. Marlite, Inc; Standard FRP: www.marlite.com/#sle.
 - 3. Nudo Products, Inc; FiberLite FRP: www.nudo.com/#sle.
 - 4. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 9 feet.
 - 2. Panel Thickness: 0.09 inch.
 - 3. Surface Design: Embossed.
 - 4. Color: As indicated in Finish Schedule.
 - 5. Attachment Method: Adhesive only, with trim at perimeter and corners and sealant in intermediate joints..

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
 - 4. Sanitation and Cleanability: Comply with 9 CFR 416.2.
 - 5. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
 - 6. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

**SECTION 07 11 13
BITUMINOUS DAMPPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Protection boards.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Substrate

1.03 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- B. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
- C. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience and approved by manufacturer.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.02 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Composition: ASTM D4479/D4479M Type I, asbestos free.
 - 2. VOC Content: Not more than permitted by local, State, and federal regulations.
 - 3. Applied Thickness: 1/8 inch, minimum, wet film.
 - 4. Products:
 - a. W. R. Meadows, Inc; Sealmastic Spray-Mastic: www.wrmeadows.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BITUMEN MATERIALS

- A. Cold Asphaltic Type:
 - 1. Emulsified Asphalt: ASTM D1227/D1227M, unreinforced, Type III, Class 1 or 2.
 - 2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.04 ACCESSORIES

- A. Protection Board, below grade: Type recommended by waterproofing manufacturer.

- B. Protection Board, above grade: Fiberglass reinforced plastic (FRP) sheet; resistant to UV, stain, odor, moisture and shattering.
 - 1. Thickness: 0.060 inch.
 - 2. Width: Contractor to select based on project conditions. Available in 12, 24, and 48 inch heights.
 - 3. Color: Selected by Architect from manufacturer's standard colors.
 - 4. Accessories: Provide manufacturer recommended components, fasteners, adhesives and trim; where exposed, provide matching color to sheet product
 - 5. Warranty: 10 years
 - 6. Product:
 - a. Nudo Inc.; GroundBreaker.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

- A. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Prime surfaces in accordance with manufacturer's instructions.
- C. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.
- D. Apply bitumen by spray application.
- E. Seal items watertight with mastic, that project through dampproofing surface.
- F. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.
 - 1. Mechanically fasten above-grade protection as recommended by manufacturer.
- G. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 07 27 00 AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air barriers.

1.02 RELATED REQUIREMENTS

- A. Section 07 27 00 - Sheathing: Substrate
- B. Section 13 34 00 - Pre-Engineered Building Systems: Interior vapor retarder.

1.03 DEFINITIONS

- A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation methods.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

- A. Air Barrier Sheet, Mechanically Fastened:
 - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
 - 3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, Class A, when tested in accordance with ASTM E84.
 - 5. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2-1/2 inches wide, compatible with sheet material; unless otherwise indicated.
 - 6. Products:
 - a. DuPont de Nemours, Inc; Tyvek Construction Wrap with Fluid-applied and self-adhered flashing accessories: building.dupont.com/#sle.
 - b. Henry, a Carlisle Company; WeatherSmart Commercial: www.henry.com/#sle.

- c. TYPAR; TYPAR BuildingWrap: www.typar.com/#sle.
- d. VaproShield, LLC; Wrap-Shield: www.vaproshield.com/#sle.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

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. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - On Exterior:
 - 1. Install sheets shingle fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
 - 3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
 - 4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
 - 5. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
 - 6. Where stud framing rests on concrete or masonry substrate, extend lower edge of air barrier sheet at least 4 inches below bottom of framing and seal to substrate with sealant or approved mounting tape.
 - 7. Install air barrier underneath jamb flashings.
 - 8. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
- E. Openings and Penetrations in Exterior Air Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings 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 with nonflanged frames, seal air 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 air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Do not cover installed air barriers until required inspections have been completed.
- C. Take digital photographs of each portion of installation prior to covering up air barriers.

3.05 PROTECTION

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

END OF SECTION

**SECTION 07 72 00
ROOF ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Snow guards.

1.02 RELATED REQUIREMENTS

- A. Section 07 41 13 - Metal Roof and Soffit Panels

1.03 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
 - 2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 SNOW GUARDS

- A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard pipe, bar, channel, or solid rod, set in brackets or posts, with plates and metal trim to match roof color.
 - 1. Extruded Aluminum Channel: Manufacturer's standard shape; with slot for insertion of metal trim matching roof.
 - 2. Supplemental Plates and Clips: Attached to horizontal component; match finish of pipe, tube, rod, or channel.
 - a. Ice Flags: Manufacturer's standard to prevent the migration of snow and ice beneath the crossmembers.
 - 3. Clamps for Standing Seam Roof: Aluminum clamps attached to standing seams of roof panels; for attachment of fence type snow guard.
 - a. Seam Profile: Selected by Architect from manufacturer's standard range; match profile of metal roof.
 - b. Finish: Mill finish.
 - 4. Products:

- a. Construction Metal Products, Inc; Construction Metal Snow Guards: www.aceclamp.com/#sle.
- b. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; ColorGard: www.s-5.com/#sle.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

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. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. 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.

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- C. ASTM C834 - Standard Specification for Latex Sealants.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
- I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- K. SCAQMD 1168 - Adhesive and Sealant Applications.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include 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. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- H. 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.

- I. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
- J. Executed warranty.

1.04 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 and with at least three years of documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver sufficient samples to manufacturer for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
- E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
 - 1. Identification of testing agency.
 - 2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Test date.
 - b. Copy of test method documents.
 - c. Age of sealant upon date of testing.
 - d. Test results, modeled after the sample form in the test method document.
 - e. Indicate use of photographic record of test.
- F. Field Quality Control Plan:
 - 1. Field testing agency's qualifications.
 - 2. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- G. 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.
- H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
 - 1. Sample: At least 18 inches 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 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 before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.02 NONSAG JOINT SEALANTS

- A. General Purpose Exterior Sealant - Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M, A, G, and O; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Color: To be selected by Architect from manufacturer's standard range.
 6. Cure Type: Single-component, neutral moisture curing.
 7. Applications:
 - a. Wall expansion and contraction joints.
 - b. Joints between door, window and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Control, expansion, and soft joints in masonry.
 - f. Joints between concrete and other materials.
- B. Sanitary Sealant - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: White.
 2. Applications:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- C. Wet Area Floor Sealant - Nonsag Traffic-Grade Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 20 to 30, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Applications:
 - a. Interior control and expansion joints in concrete floors considered wet areas.
- D. Acoustical Sealant - Acrylic-Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.
3. Color: White.
4. Products:
5. Applications:
 - a. In sound-rated wall assemblies, and where not indicated as fire-rated.
 - 1) gaps between top stud runner and structure, between bottom stud track and floor, between gypsum wall board and floor, and between gypsum wall board and structure.
 - 2) gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
- E. General Purpose Interior Sealant - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 1. Color: To be selected by Architect from manufacturer's standard range.
 2. Grade: ASTM C834; Grade NF.
 3. Applications:
 - a. Interior wall and ceiling control joints in non-wet areas.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Other interior joints for which no other type of sealant is indicated.
- F. Moving Joint Sealant - Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.
 1. Applications:
 - a. Lap Joints in Sheet Metal Fabrications.
 - b. Lap Joints between Manufactured Metal Panels.

2.03 SELF-LEVELING JOINT SEALANTS

- A. Type - Exterior Pavement Sealant - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Color: Gray.
 4. Applications:
 - a. Control and Expansion Joints in Concrete Paving.
- B. Interior Slabs (unpolished) - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 1. Composition: Multicomponent, 100 percent solids by weight.
 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 3. Color: To be selected by Architect from manufacturer's standard colors.
 4. Joint Width, Minimum: 1/8 inch.
 5. Joint Width, Maximum: 1/4 inch.
 6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.

2.04 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

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. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 - 5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 - 1. Width/depth ratio of 2:1.
 - 2. Neck dimension no greater than 1/3 of the joint width.
 - 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Thermally insulated hollow metal doors with frames.
- D. Hollow metal borrowed lites glazing frames.
- E. Accessories, including glazing.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 09 91 23 - Interior Painting: Field painting.
- C. Section 09 96 00 - High-Performance Coatings.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. NFPA: National Fire Protection Association.
- C. SDI: Steel Door Institute.
- D. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
- N. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

- P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoor.org/sdi-certified/#sle>.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 4. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 5. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Beveled, both sides.
 - 5. Typical Door Face Sheets: Flush. Smooth, seamless, joints mitered, interlocked, welded and ground smooth.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

- a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 2 - Seamless.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 - 2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 - 3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
 - 4. Door Thickness: 1-3/4 inches, nominal.
 - 5. Weatherstripping: Refer to Section 08 71 00.
- C. Interior Doors, Non-Fire-Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 - 2. Door Core Material: Kraftpaper honeycomb.
 - 3. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
 - 3. Weatherstripping: Separate, see Section 08 71 00.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Terminated Stops: Provide at doors at rooms with integral base; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
 - 2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
- I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
- B. Glazing: Clear sheet glass, 1/4 inch (6 mm) thick, tempered.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered corners; prepared for countersink style tamper proof screws.
- D. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- D. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 36 13
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, electrically operated.
 - 1. Steel, flush with glazed lites.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Division 26 - Electrical: Conduit from electric circuit to operator and from operator to control station, empty conduit from control units to door operator, wiring connections.
- C. Division 28: Security service connection to door controller.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- G. DASMA 102 - American National Standard Specifications for Sectional Doors.
- H. ITS (DIR) - Directory of Listed Products.
- I. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- J. NEMA MG 00001 - Motors and Generators.
- K. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- L. NFPA 70 - National Electrical Code.
- M. UL (DIR) - Online Certifications Directory.
- N. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Samples: Submit one panel finish samples, 6 by 6 inch in size, illustrating color and finish.
- E. Operation Data: Include normal operation, troubleshooting, and adjusting.

- F. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience and approved by manufacturer.
- C. Comply with applicable code for motor and motor control requirements.
- D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.
- E. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for warranty requirements.
- B. Extended Correction Period: Correct defective work within a 2-year period commencing on Date of Substantial Completion.
- C. Warranty: Provide the following:
 - 1. One year manufacturer warranty on the door and window components against defects in material and workmanship.
 - 2. Five year manufacturer warranty on all hardware, track and spring components against defects in material and workmanship.
 - 3. Five year manufacturer warranty against wind damage.
 - 4. Ten year manufacturer warranty on the door sections against delamination of the insulation from the steel skins.
 - 5. Thirty-year manufacturer warranty on high performance fluoropolymer coating.
 - 6. Include coverage for electric motor and transmission.
 - 7. Provide 25,000 cycle/ three year year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sectional Doors:
 - 1. Amarr: www.amarr.com/commercial/#sle.
 - 2. C.H.I. Overhead Doors: www.chiohd.com/sle.
 - 3. Clopay Building Products: www.clopaydoor.com/sle.
 - 4. Overhead Doors; www.overheaddoor.com
 - 5. **BASIS OF DESIGN:** Raynor Garage Doors: www.raynor.com/#sle.
 - a. Steel: ThermaSeal TM200C (Morton M200C)
 - 6. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
- B. Air Leakage Rate: Less than 0.40 cfm/sq ft when tested in accordance with ASTM E283/E283M at test pressure difference of 1.57 psf.

- C. Thermal Performance: R-Value of 18.3, minimum, in accordance with DASMA TDS-163.

2.03 STEEL DOORS

- A. Steel Doors: Flush steel, insulated; lift as indicated in drawings operating style with track and hardware; complying with DASMA 102, Commercial application.
1. Door Panels: Steel construction; outer steel sheet of 27 gauge, 0.0164 inch minimum thickness, pencil grooved profile; inner steel sheet of 27 gauge, 0.0164 inch minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; polyurethane insulation.
 - a. End caps: 20 gauge, 0.0359 inch, minimum.
 2. Door Nominal Thickness: 2 inches thick.
 3. Exterior Finish:
 - a. Factory finished with PVDF; color as selected by Architect.
 - b. Texture: Stucco-embossed
 4. Interior Finish:
 - a. Factory finished with polyester baked enamel; White color.
 5. Glazed Lights: Number of glazed lights per panel, and number of rows as indicated; set in place with resilient glazing channel.
 - a. Glazing: Fully tempered glass; insulated glass units; clear with low-e coating; 1/2 inch nominal overall thickness.
 - b. Window configuration: As indicated in door elevations.
 6. Operation: Electric.

2.04 COMPONENTS

- A. Track: Galvanized steel angles, 0.094 inch minimum thickness; 2 inch size, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided stainless steel lifting cables.
1. Minimum safety factor of 5.
 2. Spring Cycle Life: 20,000 cycles.
 3. For Emergency Manual Operation: Hoist Chain requiring maximum exertion of 25 lbs force to open.
- D. Sill Weatherstripping: Resilient hollow EPDM or vinyl strip, one piece; fitted to bottom of door panel in aluminum rail, full length contact.
- E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with EPDM rubber seal weatherstripping, placed in moderate contact with door panels, replaceable.
- F. Head Weatherstripping: dual-durometer vinyl, one piece full length, replaceable.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

2.05 MATERIALS

- A. Lumber: Softwood; DFL species; kiln dried, preservative treated.
- B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating, stucco embossed surface.
- C. Float Glass: Provide float glass glazing, unless noted otherwise.
1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
 2. Clear / Clear, with Low-E coating.
- D. Insulation: Foamed-in-place polyurethane, bonded to facing.
1. R-value of 18.3.

2.06 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
 - 2. Provide tamperproof operation cycle counter.
- B. Electric Operators:
 - 1. Mounting: Side mounted on cross head shaft.
 - 2. Motor Enclosure:
 - a. Exterior Doors: NEMA MG 00001, Type 4; open drip proof.
 - 3. 3/4 hp; manually operable in case of power failure, transit speed of 12 inches per second.
 - 4. 120 volts, single phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA EN 10250, Type 1.
 - 7. Opening Speed: 12 inches per second.
 - 8. Brake: Adjustable friction clutch type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. See Section 26 05 83 for electrical connections.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at location as directed by Owner.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide wireless sensing as required with momentary-contact control device.
 - 4. Overhead door contractor to provide and install control station and devices.
- E. Control Wiring: Solid state circuitry with provisions for connection of safety edge to reverse, external radio control hook-up and maximum run timer. Provisions for timers to close, monitored reversing devices, mid stop and lock bar sensor capability. Control wiring to be provided and installed by the overhead door contractor.
- F. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to reverse door upon striking object; hollow neoprene covered to provide weatherstrip seal.
- G. Provide additional keypad operator at exterior jamb, location as directed by Architect.
- H. Hand Held Transmitter: Digital control, resettable; 2 per each overhead door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.

- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of required electrical service.
- F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- G. Install perimeter trim and closures not provided with overhead door package.

3.04 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

**SECTION 08 54 13
FIBERGLASS WINDOWS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Factory fabricated fiberglass windows with operating sash.
- B. Glazed by factory.
- C. Operating hardware.
- D. Insect screens.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 13 34 00 - Pre-Engineered Building Systems: Coordination.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
- B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- C. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage details.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.
- D. Samples: Submit one corner sample, 12 x 12 inch in size, illustrating window frame section, finished surfaces, and glass units.
- E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
- B. Maintain this minimum temperature during and after installation of sealants.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 10-year manufacturer warranty covering finish, including degradation or failure due to chemical contact. Complete forms in Owner's name and register with manufacturer.
- C. Manufacturer Warranty: Provide 5-year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of vinyl color finish. Complete form in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Windows:
 - 1. Cascadia Windows & Doors: www.cascadiawindows.com/#sle.
 - 2. Marvin: www.marvin.com/#sle.
 - 3. **BASIS OF DESIGN:** Pella Corporation; Pella Impervia Windows: www.pellacommercial.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WINDOW UNITS

- A. Fiberglass Windows: Hollow, tubular, multilayer-fiber-reinforced pultruded material; factory fabricated; with vision glass, related flashings, anchorage and attachment devices.
 - 1. Configuration: As indicated on drawings.
 - 2. Product Type: HS - Horizontal sliding window in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 3. Interior Color: White.
 - 4. Exterior Color: White.
 - 5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 7. Thermal Movement: Design to accommodate thermal movement caused by 100 degrees F temperature change without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.

2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - 1. Performance Class (PC): LC.
- B. Design Pressure (DP): In accordance with applicable codes.
- C. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.
- D. Overall Thermal Transmittance (U-Value): 0.18, maximum, including glazing, measured on window sizes required for this project.
- E. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 pounds per square foot.

- F. Air Leakage: 0.05 cfm/sq ft maximum leakage when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

2.04 COMPONENTS

- A. Frames: 2-inch wide by 3 or 3-1/4-inch deep profile; flush glass stops of screw fastened type.
 - 1. Type: Nailing flange.
 - 2. Frame Corners: Joined and bonded with neutral-cure vulcanizing silicone hot-melt adhesive, with corner lock.
- B. Sills: 1 inch nominal thickness, composite fiberglass; sloped for positive wash; fit under sash to 1/2 inch beyond wall face; one piece full width of opening.
- C. Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit.
- D. Insect Screens: Woven vinyl-coated mesh; 18/18 mesh size.
 - 1. Color: Black.
- E. Operable Sash Weather Stripping: Wool pile; permanently resilient, profiled to effect weather seal.
- F. Fasteners: Stainless steel.
- G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.
 - 1. See Section 07 92 00 for additional requirements.

2.05 GLASS AND GLAZING MATERIALS

- A. Glazing: Insulated double pane, tempered glass, clear, low-E coated, argon filled, with thermoplastic warm-edge spacer, with glass thicknesses as recommended by manufacturer for specified wind conditions.
 - 1. Setting Blocks: Manufacturer's standard.

2.06 HARDWARE

- A. Horizontal Sliding Sash: Extruded PVC interfacing tracks, limit stops in head and sill track.
 - 1. Sash Lock: Cam lock and keeper.
- B. Finish For Exposed Hardware: Match window finish.

2.07 ACCESSORIES

- A. Flashing/Sealant Tape: Pella SmartFlash.
 - 1. Aluminum-foil-backed butyl window and door flashing tape.
 - 2. Maximum Total Thickness: 0.013 inch.
 - 3. UV resistant.
 - 4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in 07 92 00 - Joint Sealants.

2.08 FABRICATION

- A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
- B. Form sills in one piece. Slope sills for wash.
- C. Form snap-in glass stops, closure molds, weather stops, and flashings for tight fit into window frame section.
- D. Form weather stop flange to perimeter of unit.
- E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

- F. Arrange fasteners to be concealed from view.
- G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.
- H. Assemble insect screen frame, miter and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- I. Double weatherstrip operable units.
- J. Factory glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Set sill members and sill flashing in continuous bead of sealant.
- E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- F. Install operating hardware.
- G. Install glass using glazing method required to achieve performance criteria; see Section 08 80 00.
- H. Seal unit to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

- A. Remove protective material from pre-finished surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

3.06 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units (ACT#).

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Turn over any remaining product in original cartons.

1.05 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. **BASIS OF DESIGN:** Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Substitutions: Not permitted.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type A.

- a. Form: A1.2, wet formed.
 - b. Pattern: F - heavily textured.
- 2. Size: 24 by 24 inches.
- 3. Thickness: 3/4 inch.
- 4. Performance Requirements: to meet or exceed the basis of design for the following criteria, in accordance with ASTM E1264.
 - a. Light Reflectance.
 - b. Noise Reduction Coefficient
- 5. Panel Edge: Reveal.
 - a. Edge Profile: Beveled.
- 6. Color: As indicated in Finish Schedule.
- 7. Suspension System: Exposed grid.
- 8. Products:
 - a. As indicated in Finish Schedule.
 - b. Substitutions: Not permitted.

2.03 SUSPENSION SYSTEMS

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch face width.
 - 3. Finish: Baked enamel.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
 - 1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 - 2. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions, as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
 - 2. Double cut and field paint exposed reveal edges.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints (PT#, EPT#).
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Gypsum Board: Finish all surfaces exposed to view.
 - 3. Steel Doors and Frames: Finish all surfaces exposed to view.
 - a. Paint all surfaces, including top and bottom edge surfaces.
 - 4. Wood: Finish all surfaces exposed to view, except those indicated to prefinished and not specified to receive additional field finishing.
 - 5. Shop-Primed Metal Items: Finish all surfaces exposed to view.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 09 96 00 - High-Performance Coatings.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- E. SSPC-SP 1 - Solvent Cleaning.
- F. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. Cross-reference to specified paint system products to be used in project; include description of each system.

3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 1. Where sheen is specified, submit samples in only that sheen.
 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
 1. Benjamin Moore & Co: www.benjaminmoore.com.
 2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 3. Pittsburgh Paints: www.pittsburghpaintsco.com/#sle.
 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of the State in which the Project is located.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: Match colors indicated in Finish Schedule, or if not indicated, as selected from manufacturer's full range of available colors.
1. Allow for same number of colors indicated in Finish Schedule, plus three additional samples, without additional cost to Owner.
 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

- A. Ferrous Metals, Latex, 2-3 Coats:
1. Application: Items not listed below for urethane.
 2. Primer: One coat of latex primer. Factory-formulated quick-drying rust-inhibitive water-based metal primer.
 - a. Products:
 - 1) Benjamin Moore; Ultra Spec HP Acrylic Metal Primer
 - 2) Diamond Vogel; Vers-Acyl 300 Acrylic DTM Primer/Finish
 - 3) PPC: Pitt-Tech Plus EP.
 - 4) Sherwin-Williams; ProCryl
 3. If factory primed, omit primer and touch up base and damaged areas with compatible primer. Consult material manufacturer for shop primer used.
 4. Top Coat:
 - a. Sheen: Semi-gloss.
 - b. Products:
 - 1) Benjamin Moore; Natura VOC Interior Latex
 - 2) Diamon Vogel; Artistry Interior/Exterior Latex
 - 3) PPC; SpeedHide Zero Interior Enamel.
 - 4) Sherwin Williams; ProMar 200 Zero Interior Latex
- B. Ferrous Metals, Primed, Latex, 2 Coat - Sprayed: Exposed structure and ducts.
1. Primer: Touch-up bare and damaged areas with compatible primer. Consult steel fabricator for shop primer used.

2. Top Coat: Two coats of sprayed dryfall enamel. Factory-formulated self-priming flat acrylic-latex interior dryfall. Applied to result in dry film thickness of not less than 2.5 mils per coat.
 - a. Sheen: Flat.
 - b. Products:
 - 1) Benjamin Moore; Latex Dry Fall
 - 2) Diamond Vogel; Luminance 300 Dri-Mist Latex
 - 3) Pittsburgh Paints; Speedhide Super Tech Water Based Interior Dry-Fog Latex
 - 4) Sherwin-Williams; Waterborne Acrylic Dryfall
- C. Gypsum Board/Plaster, Latex, 3 Coat: Walls and ceilings scheduled for painting, except those to receive epoxy or dry erase coatings.
 1. Primer: One coat of latex primer sealer. Applied to result in dry film thickness of not less than 1.5 mils.
 - a. Products:
 - 1) Benjamin Moore; Eco Spec Interior - Primer.
 - 2) Diamond Vogel; PosiPrime Pro Interior Latex Primer.
 - 3) Pittsburgh Paints; Speedhide Zero VOC Interior Latex Primer/Sealer.
 - 4) Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Primer.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements
 2. Topcoat: Two coats of latex enamel topcoat. Applied to result in dry film thickness of not less than 1.5 mils.
 - a. Sheen (walls): Eggshell.
 - b. Sheen (ceilings): Flat
 - c. Products:
 - 1) Benjamin Moore; Eco Spec Interior Paint.
 - 2) Diamond Vogel; Zero Plus Interior
 - 3) Pittsburgh Paints; Speedhide Interior Zero VOC Latex.
 - 4) Sherwin-Williams; ProMar 200 Zero VOC Interior Latex
 - 5) Substitutions: See Section 01 60 00 - Product Requirements
- D. Gypsum Board/Plaster, PreCatalyzed Water Based Epoxy, 3 Coat: Walls in wet locations, all untiled walls and ceilings in restrooms, locker rooms, and janitorial spaces.
 1. Primer: One coat of latex primer sealer. Same as listed for Gypsum Board.
 2. Topcoat: Two coats of low-odor, waterborne epoxy applied in a minimum of two coats at spreading rate recommended by manufacturer to achieve a total dry film thickness of 4.0 to 6.0 mils.
 - a. Sheen: Semi-gloss.
 - b. Products:
 - 1) Benjamin Moore; Pre-Catalyzed Waterborne Epoxy.
 - 2) Diamon Vogel; Vers-E-Poxy 131 Waterborne Acrylic
 - 3) Pittsburgh Paints; Pitt-Glaze WB1 High Performance Pre-Catalyzed Waterborne Epoxy.
 - 4) Sherwin-Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 09 96 00
HIGH-PERFORMANCE COATINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High Performance Coatings, where indicated as "HPC".
- B. Surface preparation.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Painting of interior wood and metals

1.03 REFERENCE STANDARDS

- A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
- C. SSPC-SP 1 - Solvent Cleaning.
- D. SSPC-SP 2 - Hand Tool Cleaning.
- E. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
 - 3. Color submittals will not be considered until color submittals for major materials not to be painted, such as prefinished metals, have been approved.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document that applies to application on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
- F. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
 - 3. Substitution of a different high performance coating system using MPI-approved products by the same manufacturer will be considered.
 - 4. Carboline Company: www.carboline.com.
 - 5. Diamond Vogel: www.diamondvogel.com.
 - 6. PPG Paints: www.ppgpaints.com/#sle.
 - 7. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
 - 8. Tnemec Company, Inc: www.tnemec.com.
 - 9. Substitutions: Section 01 60 00 - Product Requirements.

2.02 HIGH-PERFORMANCE COATINGS - GENERAL

- A. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.

- j. 1,2-dichlorobenzene.
- k. Diethyl phthalate.
- l. Dimethyl phthalate.
- m. Ethylbenzene.
- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

- B. Colors: as indicated in color schedule or if not indicated, as selected by Architect from manufacturer's full range.

2.03 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

- A. Ferrous Metals, semi-gloss finish:
 - 1. Primer for Exterior Non-galvanized Steel (if not shop-primed): Two-part zinc-rich primer at 3-5 mils DFT.
 - a. Carboline: Carbozinc 859 Organic Zinc.
 - b. Diamond Vogel: Endura-Zinc 768 3K Organic Zinc Rich Epoxy Primer.
 - c. PPG: Amercoat 68HS.
 - d. S-W: Zinc Clad II.
 - e. Tnemec: Tnemec 90-97 Theme-Zinc
 - 2. Intermediate Coat for exterior non-galvanized steel (if not shop-applied), and Prime Coat for exterior galvanized steel (where indicated for "paint" or "high performance coating"): Rapid curing polyamide epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 6-8 mils.
 - a. Carboline: Carboguard 888 Polyamide Epoxy.
 - b. Diamond Vogel: Mult-E-Prime 500 Hi-Build Epoxy.
 - c. PPG: Amerlock 2 (Epoxy).
 - d. S-W: B67A5 Recoatable Epoxy Primer.
 - e. Tnemec: Tnemec 161 Fascure.
 - 3. Topcoat: Aliphatic polyurethane semi-gloss enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 4.0 mils.
 - a. Carboline: 133-HB 2-Component Aliphatic Polyurethane. (Satin)
 - b. Diamond Vogel: Multi-Thane 330 High Solids Acrylic Polyurethane (Gloss)
 - c. PPG: Amercoat 450 HSG Urethane.
 - d. S-W: Acrolon 218HS Polyurethane B65-650 Series.
 - e. Tnemec: Series 1075 Endura-Shield II.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.

- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- E. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- G. Proceed with coating application only after unacceptable conditions have been corrected.
 - 1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

- A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.
- B. Clean surfaces of loose foreign matter.
- C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- D. Remove finish hardware, fixture covers, and accessories and store.
- E. Remove items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
- F. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and power tools according to SSPC-SP 11 "Power Tool Cleaning to Bare Metal" , and protect from corrosion until coated.
- I. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all new surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.
- B. Use applicators and techniques suited for coating and substrate indicated.
- C. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

- D. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
- E. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- F. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- G. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- H. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

- A. Protect finished work from damage.

END OF SECTION

SECTION 10 28 00 TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories, including but not limited to:
 - 1. Grab Bars - Standard Duty
- B. Installation of owner-furnished items, including but not limited to:
 - 1. Toilet Paper Dispenser
 - 2. Paper Towel Dispenser
 - 3. Soap Dispenser
 - 4. Framed Mirror

1.02 RELATED REQUIREMENTS

- A. Section 06 10 53 - Miscellaneous Rough Carpentry: Concealed supports for accessories, including blocking.
- B. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com.
 - 2. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 3. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
 - 4. Bradley Corporation: www.bradleycorp.com/#sle.
 - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Provide products of each category type by single manufacturer.
- C. See plans and elevations for quantities and locations.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Adhesive: Two component epoxy type, waterproof.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Owner-furnished, Contractor-installed.
- B. Paper Towel Dispenser: Owner-furnished, Contractor-installed.
- C. Soap Dispenser: Owner-furnished, Contractor-installed.
- D. Mirrors: Owner-furnished, Contractor-installed.
- E. Grab Bars: Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Nonslip grasping surface finish and snap flange concealed fasteners.
 - d. Length and Configuration: As indicated on drawings.
 - e. Products:
 - 1) **BASIS OF DESIGN:** Bobrick B-6806 Series.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section 06 10 53 - Miscellaneous Rough Carpentry for installation of blocking and concealed anchors in walls.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Grab Bars: As indicated on drawings.
 - 2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
 - 3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 10 44 00
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide.
- B. NFPA 10 - Standard for Portable Fire Extinguishers.
- C. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- C. Operation and Maintenance Data: Include test, refill, or recharge schedules and recertification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature causes freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - 2. Ansul, a Tyco Business: www.ansul.com/#sle.
 - 3. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 4. Nystrom, Inc.: www.nystrom.com.
 - 5. Potter-Roemer: www.potterroemer.com/#sle.
 - 6. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. General Requirements: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated on drawings.
- B. Multipurpose Dry-Chemical-Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C.
 - 2. Size: 10 pound.
 - 3. Finish: Baked polyester powder coat, red color.
 - 4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Locate extinguishers as indicated in Drawings.
- B. Install in accordance with manufacturer's instructions.
- C. Secure rigidly in place.
- D. Place extinguishers on wall brackets.

END OF SECTION

**SECTION 10 44 33
EMERGENCY KEY CABINETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Emergency key cabinet and supplementary items necessary for installation.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- C. Samples for Verification Purposes: 3 inch square sample of exposed metal to indicate compliance with finish specified.

1.04 QUALITY ASSURANCE

- A. Local Authority Approval: Obtain approval of local fire department for keyway access and exact location and type of emergency key cabinet mounting prior to Product Data submittal.
- B. Emergency key cabinet will be required at building entrance designated by the fire department.

1.05 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. **BASIS OF DESIGN:** Knox Company: 3200 Series; www.knoxbox.com.
- B. Substitutions: See 01 60 00 - Product Requirements.

2.02 EMERGENCY KEY CABINETS

- A. Cabinet: 1/4 inch thick steel plate housing, 1/2 inch thick steel door with interior gasket seal and stainless steel door hinge. Box and lock shall be UL Listed.
 - 1. Lock shall have 1/8 inch thick stainless steel dust cover with tamper seal mounting capability.
 - 2. Lock shall have double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
 - 3. Coordinate other necessary requirements with local fire department.
- B. Mounting Type: Surface.
 - 1. Size: 5 inches wide by 4 inches high by 3-3/4 inches deep.
- C. Finish: Manufacturer's standard weather-resistant polyester powder coat.
- D. Color: As selected by Architect from manufacturer's standard colors.

PART 3 EXECUTION

3.01 PREPARATION

- A. Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation.

3.02 INSTALLATION

- A. Install at approved location(s), in accordance with manufacturer's latest published requirements.

END OF SECTION

**SECTION 13 34 00
PRE-ENGINEERED BUILDING SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Engineered wood-framed structures, including:
 - 1. Factory-engineered walls, columns and beams.
 - 2. Factory-engineered roof trusses.
 - 3. Interior stud wall framing.
- B. Prefinished metal roof, wall, ceiling and soffit panels.
- C. Prefinished sheet metal items, including gutters and downspouts and flashing and trim.
- D. Insulation and vapor retarders.

1.02 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete: Footings and foundations, slab-on-grade.
- B. Section 04 26 13 - Masonry Veneer
- C. Section 04 72 00 - Cast Stone Masonry
- D. Section 06 16 00 - Sheathing
- E. Section 07 27 00 - Air Barriers
- F. Section 08 11 13 - Hollow Metal Doors and Frames: Exterior and interior man-doors, including glazing.
- G. Section 08 36 13 - Sectional Doors: Exterior overhead doors, including operators.
- H. Section 08 54 13 - Fiberglass Windows: Operable windows, including glazing.

1.03 REFERENCE STANDARDS

- A. Preservative Treated Lumber:
 - 1. American Wood Preservers Association (AWPA).
- B. Lumber grading rules and wood species:
 - 1. National Design Specifications for Wood Construction, current edition.
 - 2. Northeastern Lumber Manufacturer's Association, Inc. (NELMA).
 - 3. Southern Pine Inspection Bureau (SPIB): Southern Pine.
 - 4. West Coast Lumber Inspection Bureau (WCLIB): Douglas Fir.
 - 5. Western Wood Products Association (WWPA): Douglas Fir and Ponderosa Pine.
- C. MSR Lumber Producers Council (MSR) for machine stress rated lumber.
- D. National Design Specifications for Wood Construction.
- E. National Design Standard for Metal Plate Connected Wood Truss Construction (TPI).

1.04 SUBMITTALS

- A. Product Data: For each type of process and factory-engineered product. Indicate component materials, dimensions, profiles, and construction and installation details.
 - 1. Include information for specialty accessory products specified for this Project.
 - 2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 3. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
 - 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Sizes, stress grades, and species of lumber.
 2. Anchor-bolt layout.
 3. Structural Framing Drawings: Show complete fabrication of primary and secondary framing. Include provisions for openings and the following information:
 - a. Slope or depth, span, and spacing of truss.
 - b. Heel bearing height.
 - c. Design loading to include:
 - 1) Top chord live load.
 - 2) Top chord dead load.
 - 3) Bottom chord dead load.
 - 4) Concentrated loads and their points.
 - d. Adjustments to lumber and plate design values for conditions of use.
 - e. Plate type, thickness of gauge, and size.
 - f. Lumber size, species and grade for each member.
 4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Indicate the following components:
 - a. Roof mounted items.
 - b. Wall mounted items.
 5. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located. Include seal and signature of professional engineer on Shop Drawings.
- C. Design Data: Engineering calculations for loading and stresses, bearing seal and signature of professional engineer licensed in the State in which Project is located. Include the following calculations:
1. Minimum design shall meet design standards of latest edition of International Building Code unless other, more stringent requirements are in force in Project location.
 2. Bending moments and axial forces for each member.
 3. Basic plate design values.
 4. Design analysis for each joint indicating that proper plates have been used.
 5. Provide design calculations for exterior walls, canopies, soffit systems, and lateral bracing walls. Design wind loads and lateral bracing loads are indicated on structural Drawings.
 6. Submit design calculations that have been engineered and certified by professional engineer licensed in the State in which Project is located. Include seal and signature of professional engineer on calculations
- D. Samples for Initial Selection: For units with factory-applied color finish, color chart of manufacturer's standard colors.
- E. Sample Warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with minimum 5 years' documented experience that participates in recognized quality-assurance program that complies with quality-control procedures and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis (calculations) by qualified professional engineer.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

- C. Source Limitations: Obtain engineered post frame building components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.
- D. Truss Assembly Quality
 - 1. Manufacturer shall provide evidence of compliance with quality control requirements of TPI-1.
 - 2. Trusses shall be stamped to indicate quality assurance auditing by an independent agency
- E. Prefinished Ribbed Metal Panels
 - 1. Manufacturer shall provide evidence of compliance with UL2218 and UL790 (Hail impact and external fire resistance, respectively) for roofing panels.
 - a. Prefinished Ribbed Metal Panels to be applied as roofing shall be delivered with a certificate to indicate compliance with UL2218 Class 4 and UL790 Class A

1.06 REGULATORY REQUIREMENTS

- A. Contractor shall be responsible for compliance with all applicable building codes and ordinances covering the work.
- B. Contractor shall cooperate with regulatory agencies or authorities to provide data as requested.

1.07 FIELD MEASUREMENTS

- A. Field measurements shall be taken to verify that components match shop drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store materials per manufacturer's requirements.
- B. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
 - 4. Store trusses to avoid contact with other materials that could create staining or discoloration.
- C. Inspect trusses upon deliver to Project site and notify manufacturer immediately if members have damage from handling or show discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.
- D. Store roofing and siding panels to allow water to drain freely.
- E. Do not store panels in contact with other materials that could cause corrosion, discoloration, or staining.

1.09 PROJECT CONDITIONS

- A. Contractor shall coordinate the work with other trades.
- B. Contractor shall fit carpentry work to other work. Scribe and cope as required for accurate fitting.
- C. Contractor shall be responsible to correlate location of furring, interior stripping, blocking and supports to allow for attachment of other work.

1.10 WARRANTY

- A. Manufacturer's Special Warranty - Treated Material: Manufacturer agrees to repair, restore, or replace columns that fail in materials within specified warranty period.
 - 1. Warranty Period: 50 years from date of Substantial Completion.
 - 2. Manufacturer shall repair treated structural columns that fail because of insect damage or because of decay that occurs under normal conditions and proper use. If manufacturer is not able to repair structural posts to satisfaction of Architect and Owner, manufacturer shall replace damaged treated structural columns.

- B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
- C. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes the following:
 - a. Color fading more than 5 Hunter units when tested per ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested per ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: From date of Substantial Completion, 35 years.
 - 3. Warranty Exclusions: Manufacturer will not warrant metal panel finishes damaged due to exposure to atmospheric pollutants including animal waste or other corrosive conditions. Manufacturer will not warrant labor by others.
 - 4. Manufacturer shall repair painted steel roofing or siding panels if the paint peels, cracks, checks, flakes or blisters to an extent that is apparent by ordinary outdoor visual observation when exposed to normal weather and atmospheric conditions. If manufacturer is not able to repair steel panels to satisfaction of Architect and Owner, manufacturer shall replace damaged steel panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Post-Frame Building Systems:
 - 1. Cleary Building Corp: www.clearybuilding.com
 - 2. Energy Panel Structures, Inc.; www.epsbuildings.com
 - 3. Lester: Uni-Frame II
 - 4. **BASIS OF DESIGN:** Morton Buildings, Inc., www.mortonbuildings.com
 - 5. Wick Buildings; www.wickbuildings.com
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM DESCRIPTION

- A. Post-Frame Construction
 - 1. Clear span
 - 2. Primary Framing
 - a. Columns
 - b. Trusses
 - c. Lateral bracing
 - 3. Secondary framing
 - a. Perimeter baseboards / preservative-treated
 - b. Wall girts (nailers)
 - c. Purlins
 - d. Overhang rafters and fascia
 - e. Ancillary blocking or furring as required
- B. Interior Wall and Ceiling Framing
 - 1. 2x4 stud walls and ceiling joists, as indicated in Drawings.
- C. Roof Covering:
 - 1. Prefinished ribbed metal panels.
 - a. Material: Galvanealed Steel, 26 gage minimum
 - b. Profile: Ribbed, as selected by Architect from full range.
 - c. Finish: PVDF
 - d. Color: As selected by Architect from full range.
- D. Soffits:

1. Prefinished metal panels.
 - a. Material: Steel, 26 gage minimum
 - b. Profile: Planks, as selected by Architect from full range.
 - c. Finish: PVDF
 - d. Color: As selected by Architect from full range.
- E. Wall Covering:
 1. Prefinished ribbed metal panels.
 - a. Material: Galvanealed Steel, 26 gage minimum
 - b. Profile: Corrugated, as selected by Architect from full range.
 - c. Finish: PVDF
 - d. Color: As selected by Architect from full range.
- F. Liner Panels:
 1. Prefinished metal panels.
 - a. Material: Steel, 26 gage minimum
 - b. Profile: Manufacturer's standards
 - c. Finish: Silicone polyester
 - d. Color: As selected by Architect from full range.

2.03 PERFORMANCE CRITERIA

- A. Design Requirements:
 1. Design wood members per formulas published in National Design Specifications (NDS) for Wood Construction.
 2. Design light metal-toothed connector plates and joint design in compliance with Truss Plate Institute's (TPI) National Design Standard for Metal Plate Connected Wood Truss Construction.
 3. Roof and wall system shall be able to withstand the imposed loads with maximum allowable deflection in accordance with the IBC.
 - a. Assembly shall permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
 - b. Size and fabrication of roof and wall systems to be free of distortion or defects that would be detrimental to appearance or performance
 - c. Include unbalanced roof loads required by ASCE-7, current edition.
- B. Thermal Resistance of Roof and Wall Assemblies: As indicated in Drawings.
- C. Thermal Resistance of Opening Assemblies: As indicated in Drawings.

2.04 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing or flashing.
 - d. Treat lumber less than 18 inches above grade.
 - e. Treat lumber in other locations as indicated.
 2. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.

- a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
- b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

2.05 MATERIALS - FOUNDATIONS

- A. Cast-in-Place Concrete:
 - 1. Foundations: Complying with Section 033000.
 - 2. Slab on Grade: Complying with Section 033000.

2.06 MATERIALS - WOOD

- A. Lumber grades as recommended by supplier.
- B. Laminated Columns:
 - 1. Columns to 20 Feet Lengths: Full-length (unspliced) nail laminated plys. Provide middle ply with short truss support block.
 - 2. Columns over 20 Feet Lengths: Spliced laminated plies per approved Shop Drawings and manufacturer's design.
 - 3. Preservative-Treatment: Treat portions of columns designed to be in contact with ground to net retention of 0.60 pounds per cubic foot of CCA per AWPA U1 requirements.
- C. Wood Trusses: Factory-fabricated of surfaced lumber (S4S) and compliant with SPIB visual and structural grade requirements.
 - 1. Lumber:
 - a. Top and Bottoms Chords: Southern yellow pine or comparable Spruce-Pine-Fir.; of size and grade to meet design requirements.
 - b. Webs: Southern yellow pine or comparable Spruce-Pine-Fir.; of size and grade to meet design requirements.
 - 2. Metal Connector Plates: Fabricated from ASTM A653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A); hot-dip galvanizing coating designation.
 - a. Compliant with applicable ICC-ES Report specifications
 - b. Plates installed in accordance with Truss Plate Institute TPI-1
- D. Baseboards: 2 inch by 8 inch, No. 2 or better Southern yellow pine, tongue-and-groove.
 - 1. Provide where indicated.
 - 2. Preservative-treated for ground contact conditions.
- E. Wall Girts: 2 inch by 4 inch.
- F. Purlins and Truss Ties: 2 inch by 4 inch, laid on edge, MSR SPF 1650.
 - 1. Purlins may be installed over top chord of truss, flat, or in purling hangers. Where purlins and truss ties are set in hangers, provide 2 inch by 6 inch laid on edge.
- G. Overhang Framing: Fabricated rafter frames, factory beveled fascia boards, 2 inch by 6 inch.
- H. Wind Bracing:
 - 1. 2 inch by 6 inch, from end wall column to first truss back.
 - 2. 2 inch by 4 inch diagonal in roofline bracing as required by design.
- I. Opening Framing: 2 by 4 or 6 inch
 - 1. Provide around personnel doors, windows, and overhead sectional door openings.
- J. Headers: Built-up as required to meet loading designs.
- K. Incidental Framing: 2 by 4 or 6 inch,

2.07 MATERIALS - PREFINISHED METALS

- A. General: Factory-formed metal panels, roll-formed in manufacturer's facility, field assembled and installed by mechanical means to support structure.
 - 1. Include all accessories required for weathertight installation.

- B. Metal Panels: Exposed-fastener metal roof and wall panels, formed with raised ribs and recesses.
 - 1. Applications: Roof, exterior wall, soffit and interior liner panels.
 - 2. Material: Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
 - a. Thickness: 26 gage.
 - b. Exterior Finish: PVDF (70% polyvinylidene difluoride)
 - c. Color(s): As selected from manufacturer's full range for exterior, White for interior.
 - 3. Profile: As selected from manufacturer's full range.
 - 4. Panel Coverage: 36 inches, typical.
 - 5. Panel Depth: 3/4 to 1-1/2 inches.
- C. Metal Trim: Match material and color of metal panel, minimum 10 foot lengths.
 - 1. Provide trim for corners, ridge lines, rakes, eaves, and panel bases.
- D. Soffits: Aluminum or steel, vented as required.
 - 1. Color: As selected by Architect from manufacturer's full range.
- E. Gutters and Downspouts: Roll-formed from 0.030" aluminum prefinished with PVDF on exposed critical visual surfaces.
 - 1. Color as selected from manufacturer's standards.
 - 2. Gutters: K-Style, in 5" or 6" open widths
 - 3. Downspouts: Rectangular, sized to match gutter size
- F. Ridge Vent: Manufacturer's standard pre-engineered ridge cap or ridgelite, flashings, and eave and gable trim. Field-fabricate minor flashings as indicated on approved Shop Drawings.
 - 1. Provide manufacturer's standard ridge vents.
 - 2. Continuous Vented Ridge: 12 square inches per lineal foot

2.08 RELATED MATERIALS

- A. Sheathing: By others, coordinate with supplier.
 - 1. See Section 06 16 00 - Sheathing for requirements.
- B. Air Barrier: By others, coordinate with supplier.
 - 1. See Section 07 27 00 - Air Barriers for requirements.
- C. Walk Doors: By others, coordinate with supplier.
 - 1. See Section 08 11 13 - Hollow Metal Doors and Frames for requirements.
- D. Sliding Windows: By others, coordinate with supplier.
 - 1. See Section 08 54 13 - Fiberglass Windows for requirements.
- E. Overhead Doors: By others, coordinate with supplier.
 - 1. See Section 08 36 13 - Sectional Doors for requirements.
- F. Unfaced, Glass-Fiber Blanket Insulation: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Application: Exterior wall thermal insulation and interior wall sound insulation.
 - 2. Surface Burning Characteristics per ASTM E84:
 - a. Flame Spread: 25.
 - b. Smoke Developed: <50.
 - 3. R-Value, exterior walls: ____, minimum
- G. Glass-Fiber Loose-Fill Insulation: ASTM C764, Type I for pneumatic application.
 - 1. Application: Above-ceiling.
 - 2. R-Value: ____, minimum
 - 3. Surface Burning Characteristics per ASTM E84:
 - a. Flame Spread: 5.
 - b. Smoke Developed: 5.
 - 4. Provide baffles as required to maintain roof ventilation near soffits.

- H. Vapor Retarder Sheet:
 - 1. Material: Polyethylene sheeting complying with ASTM D4397, clear colored.
 - 2. Thickness: 10 mil, 0.010 inch, nominal.
 - 3. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M.
 - 4. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2 inches wide; compatible with sheet material.
- I. Corner bracing
 - 1. Provide 1-1/4" wide high tensile steel strapping to be installed in all unobstructed corners in a "X" configuration
- J. Roofing / Siding / Wainscot fasteners
 - 1. Center-drive stainless steel screws with EPDM-gasketed washers for ribbed steel panels
 - 2. Fasteners shall be painted to match selected colors
- K. Closure strips
 - 1. Strips shall be made from closed cell foam
- L. Sealant
 - 1. 100% neutral curing silicone sealants shall be applied where required.
 - 2. Paintable sealant shall be applied where required.

2.09 FABRICATION

- A. Shop-fabricate wood trusses in TPI inspected plant.
- B. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- C. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- D. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- E. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Verify that mechanical and electrical utilities are in correct position.
- D. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent framing, connections, and bracing are in place unless indicated otherwise.

3.03 ERECTION OF FRAMING

- A. General: Do not use materials that are unsound, warped, improperly finished, or with defective surfaces, sizes, or patterns.

1. Comply with frame manufacturer's approved Shop Drawings for details and building erection.
 2. Comply with NFBA document "Accepted Practices for Post-frame Construction Framing Tolerances."
- B. Columns:
1. Auger hole to depth of diameter indicated on Drawings.
 2. Pour ready mix concrete pad in bottom of each hole per Drawings.
 3. Install hold down blocks at bottom of each column per approved Shop Drawings.
 4. Accurately position column in hole.
 5. Backfill with dry soil compacted in 8 inch lifts.
- C. Baseboards: Install 1 run of 2 inch by 8 inch tongue-and-groove plank, at grade, using manufacturer recommended fasteners.
- D. Wall Girts: Install at centers indicated on Drawings.
1. If required, install overhang framing at top of wall girts.
- E. Trusses:
1. Set trusses in place in center of column using lifting methods as approved by manufacturer.
 2. When trusses are properly positioned, install 1/2 inch by 5-1/2 inch machine bolt and manufacturer recommended 20d ring shank nails through 2 of column laminates and truss heel.
 3. Brace trusses per WTCA guidelines and BCSI Manual
- F. Purlins: Install purlins with fasteners and at spacings per approved Shop Drawings.
- G. Truss Ties: Install truss ties at locations recommended by structure manufacture and per approved Shop Drawings
1. Run truss ties from end wall to end wall.
- H. Incidental Framing: Install 2 inch by 4 inch or 2 inch by 6 inch blocking as required per structure manufacturers recommendations.

3.04 PANEL INSTALLATION, GENERAL

- A. Install panels per manufacturer's established construction procedures.
- B. Install panels and components plumb, square, straight, and true to lines, and to assure freedom from rattles.
- C. Take care when cutting prefinished materials to ensure cuttings do not remain on finished surface.
- D. Properly install fasteners taking care to not under- or overdrive.

3.05 PANEL INSTALLATION

- A. Roofing Panels: Install panels perpendicular to supports aligned straight with end fascias and fasten to purlins. Anchor with fasteners at spacings recommended by manufacturer and design loads.
- B. Wall Panels: Install panels perpendicular to wall girt and purlin supports, aligned level and plumb. Anchor with fasteners at spacings recommended by manufacturer and design loads.
- C. Vented Ridges: Fasten vented ridges to structure as indicated on Drawings, maintaining manufacturer's minimum clear throat opening.
- D. Soffits: Install soffits to interlock with trim items at top of steel siding and at facias.
 1. A combination of solid and perforated soffits shall be provided for balanced ventilation at side overhangs.
- E. Trim Items: Install trim items at base, wainscot transitions, corners, top of steel siding, facia, gables, and ridges using no less than 1 inch screw fasteners.

1. Trim items shall be installed at the base, at any wainscot transition, corners, top of steel siding, fascias, gables and ridge using appropriate 1" screw fasteners.

F. Closure Strips: Provide closure strips at top and bottom of roofing panels.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.
- C. Variation from Plane: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- D. Framing Members
 1. 1/4" from level.
 2. 1/8" from plumb.
- E. Siding and Roofing Panels
 1. 1/8" from true position.

3.07 CLEANING

- A. Waste Disposal:
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 22 05 00
PLUMBING COMMON WORK RESULTS**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the equipment and systems indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Plumbing work shall comply with specification section 230500.
- B. In addition to Division 22, Plumbing work shall comply with the following sections:
 - 1. Section 230500 HVAC Common Work Results
 - 2. Section 230529 Pipe Hangers and Supports
 - 3. Section 230553 Mechanical Identification
 - 4. Section 230593 Cleaning and Testing
 - 5. Section 230594 Testing Adjusting and Balancing
 - 6. Section 230719 Piping Insulation

1.3 SUBMITTALS

- A. Submittals must be reviewed and approved by the Contractor before submitting them to the Engineer.

1.4 REGULATORY AND UTILITY REQUIREMENTS

- A. Contractor is responsible for coordinating all required site inspections by authorities having jurisdiction. Contractor shall notify General Contractor of all scheduled inspections seven (7) working days prior to site visit.
- B. Contractor is responsible for paying for all fees, permits, and inspections required to complete their work.
- C. Contractor shall include all work required to install new and relocate utilities and meters as shown on drawings.
- D. Utility work 5'-0" from outside of building is by others, unless shown otherwise.
- E. Contractor shall notify Owner of any utility service shutdown 48 hours in advance. This includes water, sanitary, and storm systems.

1.5 SUBSTITUTIONS

- A. All manufacturers listed as Acceptable Manufacturers in each specification section are considered equal to the basis of design. The basis of design is preferred and will take precedence. Any products from an alternate approved manufacturer need to meet the requirements and performance specified and shall be equal to the basis of design.
- B. The Contractor may request permission for a substitution of any item (equipment or material), subject to the following conditions:
 - 1. Submit substitution requests in writing to the Engineer, on a form supplied by the Engineer. A sample copy of this form is included at the end of this section. An electronic copy can also be provided to the Contractor by the Engineer.
 - 2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contractor documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed as well as any re-design costs incurred by the Architect or Engineer. The Contractor is also responsible for coordinating changes required by other trades.
 - 3. Any requests for alternate manufacturers must be submitted to the Architect/Engineer at least ten (10) days prior to bid day. Incomplete substitution requests will not be considered.
- C. Approval
 - 1. No work involving requests for substitution shall commence without written approval on the provided form by the Engineer.
 - 2. Any work started or material ordered/installed by the Contractor without written approval shall be removed/repared at the sole expense of the Contractor. The Contractor will also be responsible for any costs incurred by the Owner for such rework.

PART 2 - PRODUCTS

2.1 PAINT

- A. For indoor applications, use paints and primers that have a VOC content of 250 g/L or less when calculated according to the adopted version of the Green Seal Standard GC-03, Anti-Corrosive Paints.

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Refer to specification section 230500 HVAC Common Work Results and individual equipment specifications for additional requirements.

3.2 PAINTING

- A. Exposed piping in occupied areas to be painted by others. Coordinate color with architect.
 - 1. Contractor to prep piping as needed to accept paint.
- B. Contractor shall paint the following items with two (2) coats of exterior enamel over one (1) coat primer. Select paint to be compliant with material being used, i.e. metal, plastic, etc:
 - 1. All exposed plumbing piping. Color to be coordinated with the Architect.

END OF SECTION

SECTION 22 05 23 PLUMBING VALVES

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Plumbing Valves indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section
 - 1. All valves shown on the plumbing drawings.
 - 2. Valves to isolate all plumbing fixture groups.
 - 3. Valves to isolate water heaters and other plumbing equipment.
 - 4. Valves to isolate owner provided equipment.
 - 5. Valves for makeup water connections serving hydronic systems.

1.2 REFERENCES

- A. Abbreviations
 - 1. IBBM: Iron body, bronze mounted.
 - 2. OS&Y: Outside screw and yoke.
 - 3. WOG: Water, oil, gas.
 - 4. WSP: Working steam pressure.

1.3 SUBMITTALS

- A. Product Data: Catalog sheets, specifications and installation instructions for each valve type.
- B. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Comply with the most recent version following standards:
 - a. Safe Drinking Water Act (SDWA) and the associated lead content requirements.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

- A. Acceptable Manufacturers (unless specified otherwise)
 - 1. Apollo
 - 2. Conbraco
 - 3. Crane
 - 4. Hammond
 - 5. Milwaukee
 - 6. Nibco
 - 7. Stockham
 - 8. Victaulic
 - 9. Watts
 - 10. HCI Terminator
- B. Valve Standardization: Valves from one or more manufacturers may be used, however valves supplied for each specific valve type shall be the product of one manufacturer.
- C. Valves shall be first quality, free from all imperfections and defects, with body markings indicating manufacturer and rating.
- D. Valve parts of same manufacturer, size and type shall be interchangeable.
- E. Valves which use packing shall be capable of being packed when wide open and under full working pressure.
- F. Size valves the same size as the piping in which they are installed, unless specified otherwise.
- G. Provide extended shafts for all valves installed on insulated piping.
- H. Coordinate the end connection type with the piping and other specialties in the systems. Refer to the piping usage schedule for additional requirement. The following are acceptable styles:
 - 1. Solder
 - 2. Mechanical press
 - 3. Threaded
 - 4. Flanged

5. Grooved

- I. Provide unions in the system as needed for installation or removal of valves and specialties.

2.2 GATE VALVES

- A. GT-1: 200 psig WSP, IBBM with non-toxic, corrosion resistant coating inside and out, FDA-approved, OS&Y, non-rising stem. Valve rated for 175 psi and designed to connect to the indicator post. Bolted bonnet, resilient solid wedge disc, completely and permanently encapsulated in rubber. Delrin Anti-friction thrust bearing. UL listed. AWWA C509 Acceptable Valve.
- B. Indicator post provided by Fire Protection Contractor. Coordinate requirements and installation with Fire Protection Contractor.
- C. Coordinate end connection type with site utility contractor.

2.3 CHECK VALVES

- A. CK-1: 125 psig WSP; 200 psig WOG; bronze body; brass, bronze, or 304 stainless steel trim; Y-pattern; horizontal swing; renewable/regrindable bronze seat disc.
- B. CK-2: 125 psig WSP; 200 psig WOG; bronze body; brass, bronze, or 304 stainless steel trim; Y-pattern; horizontal swing; renewable/regrindable PTFE seat disc.
- C. CK-3: 125 psig WSP; 200 psig WOG; IBBM;; bolted bonnet; full port; horizontal swing regrindable/renewable cast bronze seat ring and disc. Discs on valves 4 inch size and larger may be cast iron with bronze face.

2.4 BALL VALVES

- A. BV-1: 150 psig WSP, 600 psig WOG, two (2) piece bronze body, full-port, solid blow-out proof 316 stainless steel stem, PTFE seats, 316 stainless steel ball, PTFE seals, corrosion resistant steel lever handles with vinyl grips, and balancing stop.

2.5 BUTTERFLY VALVES

- A. BF-1: Ductile iron body, flangeless wafer, grooved, or lugged type, (lug for each bolt hole, drilled and tapped for cap screws), with resilient PTFE or EPDM seats, ductile iron discs, stainless steel stems, and raised necks able to accommodate 2 inches of insulation.
1. Pressure Ratings:
- a. 12 inch size and Less: 200 psig WOG at 275° F.
 - b. 14 inch size and Up: 150 psig WOG at 275° F.
- B. Operators
1. 6 inch size and Less: Manual actuator handles with external indication of disc position, memory stop, and suitable means of locking actuator in any fixed position.
2. 8 inch size and Up: Worm gear operator.

2.6 WATER PRESSURE REDUCING VALVES

A. Main Water Service

1. Acceptable Manufacturers:
 - a. Fisher
 - b. Kieley
 - c. Mueller
2. Valve shall be an adjustable, direct acting, spring loaded, diaphragm operated, single seat, bottom guided type suitable for dead end service; guaranteed not to stick and shall maintain a constant discharge pressure which will not vary more than 1 psig for each 10 psig decrease in inlet pressure. Valves shall have cast iron, mild steel or bronze bodies. Valve trim shall be of stainless steel with renewable composition disc. Parts subject to wear shall be renewable.
3. Material of diaphragm and disc shall be suitable for an operating temperature to 150° F. The control line, from diaphragm casing, shall be connected to the discharge piping at least ten (10) feet downstream from pressure reducing valve. Control line shall be of same material as adjoining piping. Valves shall be standard weight for inlet pressures up to 125 psig, and extra heavy weight for inlet pressures in excess of 125 psig.

2.7 BALANCING VALVES

A. Manual Type

1. Acceptable Manufacturers:
 - a. Bell & Gossett
 - b. Conbraco
 - c. Griswold
 - d. Nexus
 - e. Nibco
 - f. Taco
 - g. Victaulic
2. All valves to be of bronze body/stainless steel construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT insert and check valve. Valve bodies to have 1/4 inch drain/purge port. Valves to have memory stop and calibrated nameplate.
3. Valves shall be leak-tight at full rated working pressure.
 - a. 1/2 to 3 inch: 300 psig at 250° F.
 - b. 1/2 to 2 inch: 200 psig at 250° F.

B. Automatic Type

1. Acceptable Manufacturers:
 - a. Circuit Solver

2. Valve shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure. As the water

temperature increases the valve proportionally closes dynamically adjusting flow to meet the specified temperature. The valve shall never fully close, even at the desired set point. There is always sufficient bypass flow back to the recirculating pump to prevent overheating or "dead heading" of the pump.

3. The valve shall be set at the factory for the desired return temperature. No field adjustments are required. The following factory temperature set points are available.
 - a. 100°F / 105°F / 110 °F / 115°F / 120°F / 125°F / 130°F / 140°F
4. The hot water system temperatures shall have the corresponding hot water recirculation temperatures:
 - a. 120°F hot water temp / 105°F hot water circ temp
 - b. 140°F hot water temp / 125°F hot water circ temp
5. The valve shall stay fully open at approximately 10°F below closing temperature.
6. The assembly shall be available in ½", ¾" and 1"
7. Valve body and all internal components are made with lead free materials with major components constructed of type 303 stainless steel.
 - a. Valve rated to 200 PSIG maximum working pressure and 250°F maximum working temperature.
8. Thermal actuator shall be spring loaded and self cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits.
9. Install valve in each domestic hot water return piping branch beyond last hot water device in that branch.
10. Balancing valves to be provided with the following accessories as indicated on the drawings:
 - a. Check valve
 - b. Strainer (20 mesh)
 - c. Thermometer
 - d. Ball valve (assembly inlet and outlet)
11. Coordinate flow arrow, especially with valves that have an integrated check valve

2.8 SAFETY AND RELIEF VALVES

- A. General Requirements: Valves shall be as specified by ASME Code governing manufacture of such valves within scope of their particular usage, i.e., Heating Boilers, Unfired Pressure Valves, etc., shall be tested, rated and listed, unless otherwise specified. Valves for applications specified shall conform to the ASME Code, Section IV, Heating Boilers and the following:
 1. Valves for combination domestic hot water heater and storage tanks shall conform to the requirements of ASME Code, Section IV and USA Standard Z21.22 and shall be NBB listed. Valves shall be of the temperature - pressure type. Thermostatic element shall, on rising temperature, cause the valve to open at 200° F and valve shall deliver its rated

capacity at 210° F and close drip tight at 195° F. Valves shall be sized in accordance with Unfired Vessel Code.

2. End Connections: Unless otherwise specified, safety valves, relief valves and safety relief valves, in sizes 3/4 inch to 3 inches IPS inclusive, may be furnished with male or female pipe thread inlet and female pipe thread outlet; valves over 3 inches IPS must be furnished with 125 lb. or 250 lb. inlet and may be equipped with 125 lb. outlet.

2.9 GAUGE COCKS

- A. Acceptable Manufacturers:
 1. Marsh Instrument Company
 2. Mueller Instruments Co.
 3. H.O. Trerice Co.
 4. Weksler Instruments Corp.
- B. Gauge Cocks: All brass construction, "T" or lever handles, built for 300 psig hydraulic pressure.

2.10 STRAINERS

- A. Acceptable Manufacturers:
 1. Zurn
 2. Watts
- B. All strainers to be of constructed of lead free brass, bronze, or copper and shall be rated for use in potable water systems and shall meet the requirements of NSF/ANSI 372. Strainers shall include 20 mesh stainless steel strainer screen and tapped access cover and pipe plug.

2.11 HEAT TRAP FITTING

- A. Acceptable Manufacturers
 1. Rheem/Ruud
 2. Prior approved equal
- B. Dielectric nipple-style heat trap to prevent heat loss through top water heater storage tank connections. Plastic ball flow control with inert thermoplastic lining for anti-corrosion. Heat trap fitting shall be factory-marked (color coded or flow direction stamped) for hot and cold installations. Ball seat to allow for thermal expansion bypass.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install valves at locations noted on the drawings and as specified below:
 - 1. Install isolation valves at branch takeoffs from mains.
 - 2. Install a common isolation valves for branch lines to each group of fixtures.
 - 3. Install isolation valves above ceiling (in an accessible location) for each fixture if fixture is not provided with integral stops.

3.2 VALVE APPLICATION SCHEDULE

- A. Schedule of valve applications for the different services is as follows:
 - 1. Cold Water, Domestic Hot Water and Circulating (CW, HW, HWC) located inside building, 125 psig and Less:
 - a. 3 inch and Less: BV-1, CK-1, CK-2.
 - b. 4 inch and Up: BF-1, CK-3.
 - 2. Building Water Service
 - a. GT-1

END OF SECTION

**SECTION 22 11 00
PLUMBING PIPING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Plumbing Piping Systems indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in this section:
 - 1. Cold Water
 - 2. Hot Water
 - 3. Sanitary
 - 4. Vent
 - 5. Water Service

1.2 REFERENCES

- A. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. The adopted version of the Uniform Plumbing Code shall be applicable to this Project unless identified by a specific edition date.

1.3 SUBMITTALS

- A. Product Data
 - 1. Catalog sheets and specifications indicating manufacturer name, pipe/fitting type, applicable reference standard, schedule, or class for specified pipe and fittings.
 - 2. Material Schedule: Itemized pipe and fitting material list for each specified piping application in Pipe and Fittings Schedule as defined in Part 3 of this specification section. Where optional materials are specified indicate option selected.
- B. Submit piping layout drawings as per specification section 230500 HVAC Common Work Results.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Comply with the most recent version following standards:

- a. Safe Drinking Water Act (SDWA) and the associated lead content requirements.
 - 2. Use only materials and methods allowed by applicable codes and authority having jurisdiction (AHJ). It is the contractor's responsibility to confirm if plastic piping is acceptable with the AHJ prior to installation.
- B. Qualification of Brazers
- 1. Comply with the following: The persons performing the brazing and their supervisors shall be personally experienced in brazing procedures.

1.5 EXTRA MATERIALS

- A. Provide new manual pipe cutting and crimp ring tools for PEX piping. Crimping tool shall be capable of crimping joints for all sizes of piping installed on job. Tools shall be same as pipe manufacturer. Tools shall include instructions.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

- A. Steel Pipe for Threading: Standard weight, Schedule 40, black; ASTM A 53 or ASTM A 135.
- B. Steel Pipe for Roll Grooving: Standard weight, Schedule 40, black; ASTM A 53, Grade B, Type F for sizes 3/4" to 1-1/2", and Type E or S for sizes 2" to 24", or ASTM A 135.
- C. Malleable Iron, Steam Pattern Threaded Fittings
 - 1. 150 lb Class: ASME B16.3.
 - 2. 300 lb Class: ASME B16.3.
- D. Cast Iron Fittings
 - 1. Drainage Pattern, Threaded: ASME B16.12.
 - 2. Steam Pattern, Threaded: ASME B16.4.
 - a. Standard Weight: Class 125.
 - b. Extra Heavy Weight: Class 250.
 - 3. Flanged Fittings and Threaded Flanges: ASME B16.1.
 - a. Standard Weight: Class 125.
 - b. Extra Heavy: Class 250.
- E. Unions: Malleable iron, 250 lb class, brass to iron or brass to brass seats.
- F. Couplings: Same material and pressure rating as adjoining pipe, conforming to standards for fittings in such pipe. Use taper tapped threaded type in screwed pipe systems operating in excess of 15 psig.

- G. Nipples: Same material and strength as adjoining pipe, except nipples having a length of less than one inch between threads shall be extra heavy.

2.2 COPPER AND BRASS PIPE, TUBING AND FITTINGS

- A. Copper Tube, Types K and L: ASTM B 88.
- B. Wrought Copper Tube Fittings, Solder Joint: ASME B16.22.
- C. Cast Copper Alloy Tube Fittings, Solder Joint: ASME B16.18.
- D. Drainage Tube, Type DWV: ASTM B 306.
- E. Wrought Copper Drainage Tube Fittings, Solder Joint: ASME B16.29.
- F. Cast Copper Alloy Drainage Fittings, Solder Joint: ASME B16.23.
- G. Chrome Plated Grade A Red Brass Threaded Pipe, Standard Weight: ASTM B 43.
 - 1. Plating: 0.02 mil chromium over 0.2 mil nickel plating, high polish finish. Unions: Cast bronze, 150 lb Class, bronze to bronze seats, threaded or solder joint.
- I. Flared Tube Fittings
 - 1. Water Tube Type: ASME B16.26.
- J. Flanges: Conform to the Standards for fittings used in systems.
 - 1. Brazing Flanges: ASME B16.24, hubs modified for brazing ends.
- K. Mechanical Press Fittings
 - 1. Copper with EPDM seals; ASME B16.51, NSF-61.

2.3 CAST IRON PIPE AND FITTINGS

- A. Bell and Spigot Soil Pipe: Service Weight, Bitumin coated; ASTM A 74, CISPI/NSF. All pipes shall be marked with CISPI and NSF listing.
- B. Bell and Spigot Soil Pipe Fittings: Service Weight, Bitumin coated; ASTM A 74, CISPI/NSF.
- C. Bell and Spigot Soil Pipe Gaskets: ASTM C564
- D. Hubless Pipe: Bitumin coated; CISPI Standard No. 301. All pipes shall be marked with CISPI and NSF listing.
- E. Hubless Pipe Fittings: Drainage Pattern, Bitumin coated; CISPI No. 301.
- F. Hubless Joint Couplings: Stainless steel shield and clamp assembly, and elastomer sealing sleeve; CISPI-310.

2.4 DUCTILE IRON PIPE AND FITTINGS

- A. Water Pipe: Bitumin coated and cement-mortar lined; AWWA C151.
 - 1. 3"- 4": Class 51.
 - 2. 6" and Over: Class 50.
- B. Fittings: Bitumin coated and cement-mortar lined; AWWA C110.

2.5 COUPLINGS AND FITTINGS FOR GROOVED END PIPE

- A. Couplings: Gruvlok Fig. 7401 or 74, or Victaulic Co.'s Style 07 or 107, having minimum pressure rating of:
 - 1. 750 psi from 1-1/2" to 4"
 - 2. 700 psi for 6"
 - 3. 600 psi for 8"
- B. Couplings: Gruvlok Fig. 7001, or Victaulic Co.'s Style 77, having pressure rating of:
 - 1. 1000 psi for 3/4" to 6"
 - 2. 800 psi for 8" to 12"
 - 3. 300 psi for 14" to 24"
- C. Fittings: By same manufacturer as couplings, having pressure ratings equal to or greater than couplings. Comply with the following standards:
 - 1. Steel: ASTM A 53 or A 106, Grade B.
 - 2. Malleable Iron: ASTM A 47.
 - 3. Ductile Iron: ASTM A 536.

2.6 PEX PIPING AND FITTINGS

- A. Acceptable Manufacturers:
 - 1. Uponor
 - 2. Rehau
- B. Pipe: Pex-a (Engel Method Crosslinked Polyethylene Piping) for potable water use. Meets ASTM Standards F-876, F-877 and E84, NSF Standards 14, 61 & 372, PEX 5306.
 - 1. Color: Piping may be white, red, or blue in color. If red/blue colored piping is used, red must be used for all hot water pipe and blue for cold water. Maintain color scheme throughout building.

2. Note: If using color coded tubing as described above, then labeling of these pipes may be omitted.
- C. Fittings: All fittings used with crosslinked polyethylene (PEXa) water distribution pipe shall be cold-expansion fittings with PEXa reinforcing ring. Meets ASTM Standard F1960. Fittings same as pipe manufacturer. All fittings shall be completely brass or polymer. Use copper stub-outs for fixture rough-ins, PEX shall not be exposed out of the wall at fixture rough-ins.
 1. Brass fittings to be lead-free ECO Brass UNS C69300
 2. Polymer fittings in accordance to ASTM D 6394
- D. Valves: Lead-free brass ball valve.
 1. Manufacturer: valve from same manufacturer as piping system.
 2. Ball valve: full-port, two-piece, positive stop shoulder, ASTM F1960 cold-expansion ends with PEXa reinforcing ring.
- E. Accessories: Stub-out plates shall be used to support rough-in piping for fixture connections.

2.7 PVC PIPING AND FITTINGS

- A. Pipe: Schedule 40 PVC , Type I, rated for 140° F, ASTM D2665
- B. Fittings: Same as pipe manufacturer; ASTM D2466. Solvent welded using solvent approved by manufacturer.

2.8 POLYPROPYLENE

- A. Acceptable Manufacturers:
 1. Enfield
 2. Orion
- B. Pipe (above grade): Schedule 40, fire retardant, factory grooved, polypropylene. Conform to ASTM F1412 and ASTM D4101.
- C. Pipe (below grade): Schedule 40, factory grooved, polypropylene. Conform to ASTM F1412 and ASTM D4101.
- D. Fittings: Same as pipe manufacturer. Schedule 40, fire retardant, polypropylene. Conform to ASTM F1412, ASTM D3311 and ASTM D4101. Includes all piping starting at the fixture served until the piping leaves the building or discharges to an acid neutralization tank.
- E. Joining Method: fusion welding.

2.9 JOINING AND SEALANT MATERIALS

- A. Thread Sealant

1. LA-CO Industries', Slic-Tite Paste with Teflon.
 2. Loctite Corp.'s No. 565 Thread Sealant.
 3. Thread sealants for potable water shall be NSF approved.
- B. Solder: Solid wire type conforming to the following:
1. Lead-free tin-silver solder (ASTM B 32 Alloy Grade E, AC, or HB)
- C. Brazing Alloys
1. Type 1: AWS A5.8, Class BCuP-5, for brazing copper to brass, bronze, or copper.
 2. Type 2: AWS A5.8, Class BAg-7, for brazing copper to steel or stainless steel.
- D. Brazing Flux: FS O-F-499, Type B.
- E. Gaskets For Use With Ductile Iron Water Pipe and Cast Iron Drainage Pipe: Synthetic rubber rings (molded or tubular): Clow Corp.'s Belltite, Tyler Pipe Industries Inc.'s Ty-Seal, or U.S. Pipe and Foundry Co.'s Tyton.
- F. Flange Gasket Material
1. For Use With Cold Water: 1/16" thick rubber.
 2. For Use With Hot Water, Air or Steam: Waterproofed non-asbestos ceramic or mineral fiber, or a combination of metal and water-proofed non-asbestos ceramic or mineral fiber, designed for the temperatures and pressures of the piping systems in which installed.
- G. Gaskets For Use With Grooved End Pipe and Fittings: Type and materials as recommended and furnished by the fitting manufacturer, for the service of piping system in which installed.
- H. Anti-Seize Lubricant: Bostik Inc.'s Never Seez or Dow Corning Corp.'s Molykote 1000.

2.10 PACKING MATERIALS FOR BUILDING CONSTRUCTION PENETRATIONS

- A. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc.
- B. Mechanical Modular Seals: Thunderline Corp.'s Link Seal wall and floor seals designed for the service of piping system in which installed.

2.11 DIELECTRIC CONNECTORS

- A. Use for all connections between piping connections of dissimilar materials.
- B. Unions
1. Rated 250 psig at 180° F; ASME B16.39; Wilkins Model DU.
 2. Rated 100 psig at 210° F; ASME B16.39; Wilkins Model DU with high temperature gasket.

3. Rated Above 100 psig and 210° F: Use Flange Electrical Insulation Kit specified below.
- C. Flange Electrical Insulation Kit: Consisting of dielectric sleeves and washers, and dielectric gasket.
 1. Rated 150 psi at 250° F: ANSI Class 150, full faced neoprene gasket with bolt holes, double phenolic washers, and Mylar sleeves; Model 150 by APS, Lafayette, LA.

2.12 PIPE SLEEVES

- A. Install pipe sleeves as noted on the drawings or indicated in this specification section. The following piping material shall be used as noted in the installation section in this specification:
 1. Type A: Schedule 40 steel pipe.
 2. Type B: No. 16 gauge galvanized sheet steel.
 3. Type C: Schedule 40 steel pipe with 1/4" steel collar continuously welded to pipe sleeve. Size steel collars as required to span a minimum of one (1) cell or corrugation, on all sides of the rough opening thru the metal deck.
 4. Type D: No. 16 gauge galvanized sheet steel with 16 gauge sheet steel metal collar rigidly secured to sleeve. Size metal collars as required to span a minimum of one (1) cell or corrugation, on all sides of the rough opening thru the metal deck.

2.13 PIPING ESCUTCHEONS

- A. Cast Brass: Polished chrome plated finish, with set screw.
- B. Cast Iron: Solid type, unplated, with set screw; Model 395 by Grinnell Corp.

2.14 THERMOMETERS

- A. Acceptable Manufacturers
 1. Weiss Instruments
 2. Prior Approval
- B. Bi-Metal Thermometers
 1. Body: Type 304 Stainless Steel, heavy glass face, and hermetically sealed.
 2. Bimetallic Element: Bimetallic element calibrated to meet temperature standards of manufacturer and helix assembly with silicon dampening.
 3. Stem: Stainless steel to match body and of a length to suit installation. Bare stem shall be used for hydronic systems in non-corrosive applications.
 4. Connector: ¾ inch, with ASME B1.1 screw threads.

5. Accuracy: Plus or minus 1 percent of scale range or one scale division, to maximum of 1.5 percent of scale range.
6. See piping application schedule for thermometer range requirements based on system type.

C. Liquid in Glass Thermometers

1. Body: Molded plastic with variable angle mounting compliant with ASME B40.200.
2. Tube: Glass with magnifying lens, blue organic liquid, nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
3. Stem: Aluminum or brass and of a length to suit installation. Bare stem shall be used for hydronic systems in non-corrosive applications.
4. Connector: $\frac{3}{4}$ inch, with ASME B1.1 screw threads.
5. Accuracy: Plus or minus 1 percent of scale range or one scale division, to maximum of 1.5 percent of scale range.
6. See piping application schedule for thermometer range requirements based on system type.

D. Digital Thermometer

1. Body: Molded plastic with variable angle mounting.
2. Stem: Aluminum or brass and of a length to suit installation. Bare stem shall be used for hydronic systems in non-corrosive applications.
3. Connector: $\frac{3}{4}$ inch, with ASME B1.1 screw threads.
4. Display: Digital
5. Accuracy: Plus or minus 2 deg F.
6. Provide thermowell compatible with thermometer based on pipe diameter and system of installation.
7. See piping application schedule for thermometer range requirements based on system type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Piping shall be stored to prevent debris from entering the piping. This shall consist of piping caps or temporary covers.

- B. Above or below grade piping that is roughed in shall have a temporary cap installed to prevent debris from entering the piping system. The cap shall be removed to allow for the final connection or continuation of piping to be installed.
- C. Install piping at approximate locations indicated, and at maximum height.
- D. Install piping clear of door swings, and above sash heads.
- E. Make allowances for expansion and contraction.
- F. Install expansion loops in PEX piping as recommended by manufacturer.
- G. Allow for a minimum of 1" free air space around pipe or pipe covering, unless otherwise specified.
- H. Install all underground piping outside the footprint of the building to meet the minimum cover and distance below the frost depth requirements listed below:
 - 1. Sanitary and Storm – 48" minimum cover (below frost depth)
 - 2. Domestic water service – 12" below frost depth of the local jurisdiction or 60" deep, whichever is greater.
 - 3. Fire service - 12" below frost depth of the local jurisdiction or 72" deep, whichever is greater.
- I. Fire service piping shall be installed to meet the cover requirements as noted in NFPA 13. Coordinate exact requirements for the project location with NFPA 13.
- J. Install horizontal piping with a constant pitch, and without sags or humps.
 - 1. Water Piping: Pitch 1/4" per 10 feet upward in direction of flow, unless otherwise noted. If it is not possible to maintain constant pitch, establish a new low point and continue. At the low point, provide a 1/2" drip leg and gate valve with a hose bibb end. Provide an air vent at the high point.
 - 2. Sanitary Piping: Pitch piping 3" and Under 1/4" per foot downward, in direction of flow, unless otherwise noted. Pitch piping 4" and Over 1/8" per foot downward, in direction of flow, unless otherwise noted.
 - 3. Grease Sanitary Piping: Pitch piping 1/4" per foot downward, in direction of flow, unless otherwise noted.
 - 4. Storm Piping: Pitch piping 1/8" per foot downward, in direction of flow, unless otherwise noted.
 - 5. Vent Piping: Pitch 1/8" per foot upward, unless otherwise noted.
- K. Install vertical piping plumb.
- L. Use fittings for offsets and direction changes, except for Type K soft annealed copper temper water tube, and mechanically extracted joints in Type L copper tubing.
- M. Cut pipe and tubing ends square; ream before joining.

- N. Threading: Use American Standard Taper Pipe Thread Dies.
 - 1. Thread brass pipe with special brass threading dies.
- O. PEX shall only be allowed individual branch or fixture piping, not mains connecting more than one (1) room.
 - 1. PEX piping shall not be installed in rated walls or ceiling spaces being used as a return air plenum.
 - 2. PEX piping shall not be installed where exposed, this includes mechanical rooms.

3.2 DRAINAGE SYSTEMS

- A. Fittings
 - 1. Long Sweep Fittings
 - a. Long sweep fittings shall be those in the category where 4" diameter piping has a minimum R/D = 10.5"/4".
 - b. Use long sweep drainage pattern fittings for all fittings unless noted otherwise.
 - c. Use of other fittings must be approved by Engineer in writing prior to use.
 - 2. Short Sweep Fittings
 - a. Short sweep fittings shall be those in the category where 4" diameter piping has a minimum R/D = 7.5"/4".
 - b. Short sweep drainage pattern fittings may be used for the following.
 - 1) Vent piping.
 - 2) Fixture connections.
 - 3) Other locations as approved by the Engineer in writing.
 - 3. Vertical Offsets: Make vertical offsets with 45° elbows, or 1/8 bends.
- B. Cleanouts
 - 1. Install cleanouts with sufficient side and end clearance to allow for the removal of the cleanout plug, and the use of cleaning tools.
 - 2. Lubricate cleanout plugs with anti-seize lubricant.

3.3 DOMESTIC WATER PIPING SYSTEM

- A. Connect branch lines to the upper quadrant of the main, and run upward at not less than 45° before extending laterally.
- B. Make final connections to plumbing fixtures and equipment with unions, or flanges.
 - 1. Do not use unions in ferrous piping larger than 3".
 - 2. Do not use unions in brass or copper piping larger than 2-1/2".

3.4 PIPE JOINT MAKE-UP

- A. Threaded Joint: Make up joint with a pipe thread compound applied in accordance with manufacturer's printed application instructions for the intended service.
 - 1. Chrome Plated Brass Pipe: Tighten joint with a strap or Parmalee wrench; do not mar pipe finish. Install piping so that no threads are visible.
- B. Soldered Joint: Thoroughly clean tube end and inside of fitting with emery cloth, sand cloth, or wire brush. Apply flux to the pre-cleaned surfaces. Install fitting, heat to soldering temperature, and join the metals with type of solder specified. Remove residue.
- C. Flanged Pipe Joint
 - 1. Install threaded companion flanges on steel pipe; flanges on galvanized pipe are not required to be galvanized.
 - 2. Provide a gasket for each joint.
 - a. Hot Water Pipe Gasket: Coat with a thin film of oil before making up joint.
 - 3. Coat bolt threads and nuts with anti-seize lubricant before making up joint.
- D. Caulked Joint: Pack hub with joint packing specified, and caulk. Run 12 ounces molten lead for each inch of pipe diameter. Caulk cooled lead ring and face off smoothly.
- E. Rubber Ring Push-on Joint: Clean hub, bevel spigot, and make up joint with lubricated gasket in conformance with the manufacturer's printed installation instructions.
- F. Grooved Pipe Joint: Roll groove pipe ends, make up joint with grooved end fittings and couplings, in conformance with the manufacturer's printed installation instructions.
 - 1. Cut grooved end piping is not acceptable.
- G. Hubless CI Pipe Joint: Make up joint with hubless fitting and couplings, in conformance with the manufacturer's printed installation instructions.
- H. Mechanical Joint: Make up joint in conformance with the manufacturer's printed installation instructions, with particular reference to tightening of bolts.
- I. Mechanical Press Joint: Install joint with tool approved by joint manufacturer. Installer shall be fully trained and have experience in installing this type of joint.
- J. PEX Joint: Cut pipe and install joints with tool approved by joint manufacturer. Installer shall be fully trained and have experience in installing this type of joint.
- K. Dissimilar Pipe Joint
 - 1. Joining Bell and Spigot and Threaded Pipe: Install a half coupling on the pipe or tube end to form a spigot, and caulk into the cast iron bell.
 - 2. Joining Dissimilar Threaded Piping: Make up connection with a threaded coupling or with companion flanges.
 - 3. Joining Dissimilar Non-Threaded Piping: Make up connection with adapters recommended by the manufacturers of the piping to be joined.

3.5 PIPING PENETRATIONS

- A. Install pre-manufactured flexible boots for vent terminations through roof. Use materials compatible with roof system.
- B. Sleeve Schedule: Unless otherwise shown, comply with the following schedule for the type of sleeve to be used where piping penetrates wall or floor construction:

CONSTRUCTION	SLEEVE TYPE
1. Frame construction.	None Required
2. Foundation walls.	A*
3. Non-waterproof interior walls.	B*
4. Non-waterproof interior floors on metal decks.	D*
5. Non-waterproof interior floors not on metal decks.	B*
6. Floors not on grade having a floor drain.	A
7. Floors over mechanical equipment, steam service, machine, and boiler rooms.	A
8. Floors finished or to be finished with latex composition or terrazzo, and on metal decks.	D*
9. Floors finished or to be finished with latex composition or terrazzo, and not on metal decks.	A
10. Earth supported concrete floors.	None Required
11. Exterior concrete slabs on grade.	A
12. Fixtures with floor outlet waste piping.	None Required
13. Metal roof decks.	C
14. Non-metal roof decks.	A
15. Waterproof floors on metal decks.	D
16. Waterproof floors not on metal decks.	A
17. Waterproof walls.	A

*Core drilling is permissible in lieu of sleeves where marked with asterisks.

C. Diameter of Sleeves and Core Drilled Holes

1. Unless otherwise specified, size holes thru floors and walls in accordance with the through penetration fire stopping system being used.
2. Size holes thru exterior walls or waterproofed walls above inside earth or finished floors, and exterior concrete slabs in accordance with the following:
 - a. Uninsulated (Bare) Pipe: Inside diameter of sleeve or core drilled hole 1/2" greater than outside diameter of pipe, unless otherwise specified.
 - b. Insulated Pipe: Inside diameter of sleeve or core drilled hole 1/2" greater than outside diameter of insulation, unless otherwise specified.

- c. Mechanical Modular Seals: Size holes in accordance with the manufacturer's recommendations.
- D. Length of Sleeves (except as shown otherwise on Drawings)
 - 1. Walls and Partitions: Equal in length to total finished thickness of wall or partition.
 - 2. Floors, Finished: Equal in length to total finished thickness of floor and extending 1/2" above the finished floor level, except as follows:
 - a. In furred spaces at exterior walls, extend sleeve 1" above the finished floor level.
 - 3. Exterior Concrete Slabs: Equal in length to total thickness of slab and extending 1/2" above the concrete slab.
 - 4. Roofs: Equal in length to the total thickness of roof construction, including insulation and roofing materials, and extending one inch above the finished roof level.
- E. Packing of Sleeves and Core Drilled Holes
 - 1. Unless otherwise specified, pack sleeves or cored drilled holes in accordance with Section 07 84 00 - FIRESTOPPING.
 - 2. Pack sleeves in exterior walls below grade and concrete floor slabs at or below with mechanical modular seals.

3.6 ESCUTCHEONS

- A. Install plates for exposed uninsulated piping passing thru floors, walls, ceilings, and exterior concrete slabs as follows:
 - 1. In Finished Spaces: chrome plated cast brass.
 - 2. Unfinished Spaces (Including Exterior Concrete Slabs): unplated cast iron.
 - 3. Fasten plates with set screws.
 - 4. Plates are not required in pipe shafts or furred spaces.

3.7 PIPE AND FITTING SCHEDULE

- A. Refer to Drawings for Piping Application Schedule.
- B. Where options are given, choose only one (1) option for each piping service. No deviations from the selected option will be allowed.

END OF SECTION

**SECTION 223300
DOMESTIC WATER HEATERS**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Domestic Water Heaters indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Water heater shall be UL listed and labeled.
- B. Water heater shall bear the seal of the American Gas Association.
- C. Comply with the Iowa State Energy Code.
- D. Water heater performance shall meet the adopted version of ASHRAE 90.1.
- E. Water heaters serving emergency fixtures shall meet all requirements of ANSI Z358.1 for tepid water.

1.3 SUBMITTALS

- A. Product Data: Catalog sheets, specifications and installation instructions for each water heater, gas vent pipe, fittings, and accessories required for the vent system.

1.4 WARRANTY

- A. Manufacturer's Warranty: Three (3) year warranty for the glass lined water heater tank. Provide a copy of the warranty as part of the closeout documents.

PART 2 - PRODUCTS

2.1 INSTANTANEOUS WATER HEATER (ELECTRIC)

- A. Acceptable Manufacturers
 - 1. Eemax
 - 2. Chronomite
 - 3. Stiebel Eltron
- B. Unit to be used to serve Restroom Group as indicated on the drawings.

- C. Microprocessor controls with temperature setpoint display and adjustment knob located on the front of the cabinet for unit located in secure area. A vandal resistant option shall be available for units located in public areas.
- D. Water heater is capable of adjusting the water temperature between 100° F and 140° F based on an entering water temperature of 50° F.
- E. Heating Elements: Stainless steel electric heating coil.
- F. Wiring: Factory interwired, requiring only a single field electric connection to put the heater into service.
- G. Outer Casing: Steel with baked enamel or acrylic finish. Access door for servicing thermostats and heating elements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the Work of this section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.
- B. Install the water heater on a level, firm base.
- C. Install the pressure-temperature relief valve in the dedicated tank tapping. Pipe the relief valve blow-off to a point 6 inches above the floor, or as shown on drawings.
- D. Install unions and shut-off valves on hot and cold water connections. Install dielectric unions if required.
- E. Flush and fill tank. Do not switch on heating elements until tank is full and entrapped air is eliminated. Install the Work of this section in accordance with NFPA 54, NFPA 211, and the manufacturer's printed installation instructions, unless otherwise specified.
- F. Install an AGA lubricated plug valve on the gas connection. Gas supply branch shall have a 6" dirt leg with a threaded cap.
- G. Vent Piping
 - 1. Support horizontal piping on five (5) foot centers, maximum spacing, support vertical piping at every floor or ten (10) foot intervals maximum.
 - 2. Install manufacturer provided concentric vent kit.
 - 3. Terminate vent extension through roof with a bird proof vent top.

END OF SECTION 223300

**SECTION 22 40 00
PLUMBING FIXTURES AND EQUIPMENT INSTALLATION**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Plumbing Fixtures and Equipment indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Refer to the Plumbing Material Lists and Equipment Schedules for additional capacity and equipment requirements.

1.3 SUBMITTALS

- A. Fixture and Equipment Data: Catalog sheets, specifications, rough-in dimensions, and installation instructions for each item specified except fasteners.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Comply with the most recent version following standards:
 - a. Safe Drinking Water Act (SDWA) and the associated lead content requirements.
 - b. Applicable sections of ANSI/ASME A112 – Standards for Plumbing Equipment
 - 2. Materials and installations designated as handicapped accessible shall conform with the following:
 - a. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
 - b. The Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), (Appendix A to 28 CFR Part 36).
 - 3. Each fixture carrier support shall be listed by model number in the fixture support manufacturer's Fixture Support Selection Guide as being recommended for support of the appropriate fixture.
- B. Plainly and permanently mark each fixture and fitting with the manufacturer's name or trade mark.
- C. Acid resistant surfaces shall be plainly and permanently marked with the manufacturer's label or symbol indicating acid resistance.

1.5 MAINTENANCE

- A. Special Tools: Deliver to the Owner.

1. Furnish the following tools labeled with names and locations where used.
 - a. Keys for stops (furnished with stops).
 - b. Tools for Vandal Resistant Fasteners: Two (2) for each type and size.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The following manufacturers are considered equal to the basis of design listed in the material list and schedules. The basis of design is preferred and will take precedence. Any products from an alternate approved manufacturer need to meet the requirements and performance specified and shall be equal to the basis of design.

Equipment	Acceptable Manufacturers
Backflow	Apollo/Conbraco, Watts/Febc/Ames, Zurn/Wilkins
Drainage Fixtures	Josam, Mifab, Smith, Sun, Wade, Watts, Zurn
Electric Water Coolers	Acorn, Elkay, Halsey Taylor, Haws, Murdock, Oasis, Sloan
Emergency Fixtures	Acorn, Bradley, Encon, Guardian, Haws, Speakman
Filter	Culligan, Everpure, Marlo, PEP, Watts
Fixture Carriers	Jay R. Smith, Josam, Mifab, Zurn
Flush Valves	Delta Commercial, Moen Commercial, Sloan, Toto, Zurn
Hose Bibbs & Misc. Valves	Apollo, Smith, Watts, Willoughby, Woodford, Zurn
Lavatories, Urinals, Water Closets (Fixtures)	American Standard, Eljer, Kohler, Sloan, Toto, Zurn
Lavatory & Sink Trim	American Standard, Chicago Faucet, Delta Commercial, Kohler, Moen Commercial, T&S Brass, Sloan, Zurn
Mixing Valves	Armstrong, Bradley, Lawler, Leonard, Powers
Mop And Service Sinks	Fiat, Stern-Williams, Zurn
Sand / Oil Interceptor	Striem, Mifab, Rockford, Zurn
Stainless Steel Sinks	Elkay, Just, Kohler
Wall Boxes	Guy Gray, LSP, Oatey, Sioux Chief
Water Hammer Arrestors	Sioux Chief, Watts, Jay R. Smith, Zurn

- B. All items shall be commercial grade unless specified otherwise.

- C. All items shall be supplied by the same manufacturer.

2.2 FIXTURE MATERIALS

- A. Vitreous China: First quality, smooth, uniform color and texture, with fused on glaze covering surfaces exposed to view.
 - 1. Surfaces shall be free of chips, craze, warpage, cracks and discolorations. Surfaces in contact with walls or floors shall be flat, with warpage not to exceed 1/16 inch per foot.
 - 2. Color: White.
- B. Porcelain Enameled Cast Iron: Smooth, uniform color and texture, having fused on glaze covering surfaces exposed to view.
 - 1. Material shall show no cracks, chips, craze or discolorations.
 - 2. Enameled surfaces shall be acid resistant unless otherwise specified.
 - 3. Color: White.
- C. Fixture Trim: Brass, bronze, or stainless steel construction; consisting of supply and waste fittings, faucets, traps, stop valves, escutcheons, sink strainers, nipples, supplies, and metal trim.
 - 1. Brass piping: IPS standard weight, with standard weight, 125 lb cast brass fittings.
 - 2. Brass tubing: 18 B & S gauge.
 - 3. Stainless steel: 18-8 Type 302 or 304 unless otherwise specified.
- D. Fixture Trim: Acid Waste Systems
 - 1. Tail pieces and p-traps for fixtures connected to acid waste systems shall be constructed of similar material to the acid waste piping.
- E. Fixture Trim Finishes:
 - 1. Brass or Bronze: Polished or satin finished chrome plating, 0.02 mil chromium over 0.2 mil nickel plating.
 - 2. Stainless Steel: Invisible welds and seams, and unless otherwise specified, polished to No. 4 commercial finish.
- F. Fixture Hold-down Bolts: Steel, plated for corrosion resistance.
 - 1. Cap nuts: Metal, polished and chrome plated.
 - 2. Vandal Resistant Fasteners: Torx head with center pin.

2.3 FIXTURE SUPPORTS AND SUPPORTING DEVICES FOR LAVATORIES, SINKS, AND EQUIPMENT

- A. General: Ferrous metal members of carriers and supporting devices, with the exception of chrome plated or porcelain enameled cast iron, shall be factory painted for corrosion resistance.
- B. Floor Mounted Carrier Supports: Steel pipe uprights, 1-1/4 inch IPS minimum diameter, or 1 inch x 2 inch steel tubing uprights, with cast iron or welded steel feet, drilled for bolting to the floor construction. Each carrier shall be provided with the appropriate fixture supporting devices specified, or recommended by the carrier manufacturer's Fixture Support Selection Guide. Floor mounted carrier supports for banks of multiple adjacent fixtures shall have provisions in the support uprights to allow for waste piping to be concealed in the associated wall.
 - 2. Concealed Arms: Steel, with fixture locking lugs, leveling screws and a means of attaching, positioning and securing the fixture to the carrier.
 - a. Trim: Polished, chrome plated metal escutcheon to space fixture two inches from the wall.
 - 3. Exposed Arms: Cast iron or steel, porcelain enamel finished, with locking lugs, and leveling screws. Include studs, nuts and washers for fixture to be supported.
 - a. Trim: Polished and chrome plated metal cap nuts and washers.
 - b. Vandal Resistant Trim: Polished, chrome plated metal cap nuts and washers retained with vandal resistant set screws or other approved means of securing trim.
- C. Wall Mounted Carrier Supports: Plate type system, with steel plates on both sides of the wall and through-bolted. On walls having an integral finish, a single plate wall carrier designed for such installations may be used. Each carrier shall be provided with the appropriate fixture supporting devices specified, or recommended by the Carrier manufacturer's Fixture Support Selection Guide.
 - 1. Concealed Arms: Steel, with fixture locking lugs, leveling screws and a means of attaching, positioning and securing the fixture to the carrier.
 - a. Trim: Polished, Chrome plated metal escutcheon to space fixture two inches from the wall.
 - 2. Exposed Arms: Cast iron or steel, porcelain enamel finished, with locking lugs, and leveling screws. Include studs, nuts, and washers for fixture to be supported.
 - a. Trim: Polished and chrome plated metal cap nuts and washers.
 - b. Vandal Resistant Trim: Polished, chrome plated metal cap nuts and washers retained with vandal resistant set screws.
- D. Bearing Plate: Steel, minimum 1/8 inch thick, and provided with bearing studs, nuts and appurtenances required by the fixture to be supported.
 - 1. Fixture Hanger: Furnished by the fixture manufacturer.
- E. Wood Stud Filler Piece: 2 inch x 8 inch wood planking cut to fit between wood studding. Fasten with four 3/8 inch x 2-1/2 inch lag bolts with washers.
- F. Water Closet Carriers
 - 1. Closet Carrier (For Wall Hung Water Closets): Commercial type cast iron combination chair carrier and drainage fitting with the following:

- a. Capacity: 500 pounds.
- b. Face Plate: Cast iron; height adjustable.
- c. Feet: Cast iron, adjustable, with provisions for bolting to the floor slab.
- d. Studs, Nuts and Washers: Steel, treated for corrosion resistance.
- e. Fixture Washers: Plastic.
- f. Adjustable Closet Connection: Cast iron, steel, or ABS plastic.
- g. Fitting Ends: Compatible with the drainage piping system.
- h. Gasket: Impregnated felt or neoprene closet gasket; lead or neoprene face plate gasket.
- i. Stud thread protectors.
- j. Factory painted.
- k. Trim: Polished chrome plated metal cap nuts and washers.
- l. Vandal Resistant Trim: Polished chrome plated metal cap nuts and washers retained with vandal resistant set screws.

2.4 SAND / OIL INTERCEPTOR

- A. Type: Factory-fabricated interceptor made for removing and retaining sand and oil from wastewater.
- B. Body Material: Polyethylene
- C. Interior Separation Device: Baffle
- D. Inlet and Outlet Size: As noted on drawings
- E. Mounting: Below Grade
- F. Provide all necessary fittings, manhole access and accessories needed for complete installation.
- G. Access: Provide manhole access where installed below concrete. Manhole to be rated for vehicle traffic.

2.5 CLEANOUTS

- A. Threaded pipe fitting or cast iron ferrule with gas tight cleanout plug.
- B. Plug: Cast brass or bronze, with threaded end, and raised or countersunk head. Tapped head for attachment of cleanout wall or deck plate covers where required.
- C. Covers: See Plumbing Material List.
- D. Anti-Seize Lubricant: Never-Seez by Bostik Chemical Group, Molycote 1000 by Dow Corning Corp, Anti-Seize Lubricant by Loctite Corp
- E. Membrane flange and clamping collar, secured with corrosion resistant fasteners.

2.6 AIR GAP FITTINGS

- A. Provide when called for in Plumbing Material List.

- B. Coated cast iron body with air gaps, set screw or threaded inlet, and outlet connection to match piping option selected.

2.7 DRAIN VALVES

- A. Provide on all equipment with drain connections and as shown on details.
- B. Cast brass body with renewable units, hose bibb vacuum breaker (ASSE 1011) with drainage feature, and removable cast iron handwheel with vandal resistant fastener.
 - 1. Valve must be completely assembled to make hose connection.
 - 2. Connections: 1/2 or 3/4 inch threaded or solder end inlet, and 3/4 inch hose bibb outlet.

2.8 WATER HAMMER ARRESTERS AND AIR CHAMBERS

- A. Provide water hammer arresters as specified on the Plumbing Material List.
- B. ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged for operation between -100° F and 300° F and maximum 250 psig working pressure.

2.11 WALL BOX WITH VALVES

- A. Box and faceplate shall be 20 gauge, white powder-coated, cold-rolled steel.
- B. The valve shall be brass, quarter-turn, lead-free valve complying with NSF 61, NSF 372, and ASME A112.18.1. Valve shall be marked for identification as lead free.

PART 3 - EXECUTION

3.1 FIXTURE SUPPORT AND SUPPORTING DEVICE INSTALLATION

- A. Install heavy duty floor mounted carrier supports with specified fixture supporting devices for wall type plumbing fixtures.
 - 1. Secure to building construction with lag bolts and metal expansion shields, or other appropriate means as required by the construction encountered.
- B. Attach fixtures to floor or wall construction as specified in the Plumbing Material List.
- C. Fixture Supporting Devices: Attach fixtures by means of the following fixture supporting devices attached to carrier supports.

FIXTURE	SUPPORTING DEVICE
Lavatory, VC, with back	Concealed arms
Lavatory, VC, no back	Concealed arms
Lavatory, ECI, with back	Exposed arms
Lavatory	Concealed arms

FIXTURE	SUPPORTING DEVICE
Lavatory	Through bolt
Water Closet	Bolt to comb. carrier and drainage fitting
Water Cooler (wall mounted)	Fixture hanger

- D. Secure exposed external components in place with vandal resistant fasteners or devices which cannot be removed without the use of special tools.

3.2 FIXTURE INSTALLATION

- A. Install the Work of this section in accordance with the manufacturer's printed installation instructions.
- B. See Architectural Floor Plans and Interior Elevation drawings for final installation locations and heights of all plumbing fixtures. Architectural plans supersede these specifications.
- C. Install fixtures level and at proper height, tighten connections, and install hold-down bolts, cap nuts and cover plates, where required.
- D. Caulk joint between all fixtures and wall or floor with sealant; strike a neat joint.
- E. Secure exposed external components in place with vandal resistant fasteners or devices which cannot be removed without the use of special tools.
- F. Filters
1. Provide adequate service clearance in front of and below units to allow for removal and replacement of filters.
 2. Include a shut off valve upstream of the filter to allow for service.
 3. Provide pressure gauges upstream and downstream of multi-stage filters to monitor pressure drop for filter replacement.
- G. Mop Service Sinks
1. Set receptor leveled in bed of mortar laid on clean roughened surface. Remove excess mortar and strike a neat joint.
 2. Make connection from drainage pipe to receptor drain.
 3. Install service fittings and miscellaneous trim such as mop hanger and wall protection as called for on Plumbing Material List.
- H. Lavatories
1. Mount lavatories 34 inches from finished floor to rim unless otherwise specified.
- I. Countertop Fixtures
1. Install fixture with securing devices supplied.

2. Set fixture on bedding of clear sealant, tighten securing devices and remove excess sealant.

J. Water Closets

1. Wall Hung Fixtures:
 - a. Standard Fixtures: Install wall hung fixtures 15 inches from finished floor to rim unless otherwise specified.
 - b. Set bearing nuts to position fixture 1/16 inch clear of finished wall.
2. Floor Supported Fixtures:
 - a. Set fixture in bed of setting compound; remove excess.
3. After connections are tightened, install cap nuts and washers.

K. Flush Valves

1. Standard Fixtures: Install flush valves on fixture centerline, and at following heights above fixture rim or back to centerline of water inlet to flush valve.
 - a. Water Closet: 11-1/2 inches.
 - b. Urinal: 11-1/2 inches.
 - c. Clinical Sink: 24 inches.
2. Handicapped Accessible Fixtures: Install flush valves on fixture centerline, and at following height above finished floor to centerline of flush valve operator. Distance between centerline of flush valve operator and centerline of water inlet is 1-1/2 inches.
 - a. Water Closet: Approximately 31-1/2 inches, and mounted on wide side of stall.
 - 1) Coordinate mounting height with General Contractor to avoid interference with grab bar, and to facilitate flush valve servicing.
 - b. Urinal: Maximum 44 inches.
3. Slip joints in flush pipe connections allowed only at fixture spud and vacuum breaker ends; others shall be screwed connections.
4. Score tubing ends before assembling to assure tight slip joint connections. No score marks shall be visible after assembly.
5. In utility corridors, solder screwed flush pipe connections.

L. Floor drains

1. Install the Work of this section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.
2. Protect weep holes from plugging during installation. Rod out weep holes after installation to remove obstructions.
3. Set drainage flange flush with top of structural floor slab, or at elevation otherwise indicated.
4. After membrane waterproofing installed and cured, secure clamping ring.

5. Adjust strainer head to height indicated. If height not indicated, set at 1/2 inch below finished floor elevation.

M. Roof Drains

1. Coordinate drain installation with deck and roofing Work.
2. Unless otherwise indicated by dimensions on the Drawings, locate drains as follows:
 - a. Place drains minimum three (3) feet away from items on roof (parapets, walls, gravelstops, pipes, vents, scuttles, equipment and curbs, etc.) to allow for flashing.
 - b. Install drains at low points of roof deck and where normal deck deflection will be at its maximum.
3. Drains in Cast Concrete: Set and securely brace drain body so that sump flange is level with, or slightly below surface of concrete.
4. Drains in Steel Decks: Install drains as shown on the Construction Work Drawings.
 - a. Do not core drill or cut openings. Coordinate roof deck openings with Construction Work Contractor.
 - b. Set sump receiver surface level with deck surface.
 - c. Secure drain body with underdeck clamp.
5. Drains in Pre-cast and Pre-stressed Concrete Deck Units: Install drains as shown on the Construction Work Drawings.
 - a. Do not core drill or cut openings.
 - b. Coordinate roof deck openings with Construction Work Contractor. Set sump receiver surface level with deck surface.
 - c. Secure drain body with underdeck clamp.
6. Fasteners
 - a. Coat bolt threads with anti-seize lubricant before final installation.

N. Drains and Inlets During Construction

1. Provide a temporary cover for all floor, roof, trench and area drains during construction to prevent debris getting into the system and protect drain grates. Remove temporary covers and clean grates at the end of construction.
2. The contractor is responsible for the flushing of all drains used during construction. This includes main and branch lines. If solids or debris in the system result in flow issues, the contractor will be required to camera and remove obstructions.

O. Wall Hydrants: Installation Height: Minimum 18 inches above finished grade.

P. Cleanout Plug: Lubricate threads with anti-seize lubricant before final installation.

Q. Water Hammer Arresters

1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Owner.

R. Wall Boxes

1. Coordinate installation height and required millwork openings with architectural plans and millwork submittals.

3.3 CLEANING, FLUSHING AND ADJUSTMENT

- A. Clean fixtures and trim. Remove grease and dirt; polish surfaces but leave stickers and warning labels intact.
- B. Flush supply piping and traps; clean strainers.
- C. Adjust stops for proper delivery.

END OF SECTION

**SECTION 23 05 00
HVAC COMMON WORK RESULTS**

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes basic mechanical requirements, which are applicable to all Division 21, 22 and 23 sections.
- B. Overview of work
 - 1. HVAC
 - 2. Plumbing
- C. In these documents, "Contractor" refers to the mechanical contractor and all their subcontractors, unless listed otherwise. The division of work within the mechanical scope is the responsibility of the lead mechanical contractor.
- D. Contractor is responsible for providing fully functional systems.
- E. If work is shown on the drawings or listed in the specifications, it shall be included by the Contractor.
- F. If equipment is provided by the Contractor, it shall be installed by the Contractor, unless noted otherwise.
- G. The drawings are necessarily diagrammatic by their nature and are not intended to show every connection in detail or every item in its exact location. Carefully investigate structural and finish conditions and coordinate the separate trades in order to avoid interference between the various phases of Work. Organize and lay out Work so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Install all Work parallel or perpendicular to building lines unless otherwise noted.
- H. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Architect and Engineer for interpretations.
- I. All sizes as given are minimum except as noted.
- J. Materials shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Architect's, Engineer's, and Owner's observations from the commencement until the acceptance of the completed work.
- K. Owner Furnished Equipment
 - 1. The following items are provided by the Owner and installed by the contractor:
 - a. Gas-fired unit heaters

2. The following items are provided and set in place by the Owner. Contractor to make final utility connections.
 - a. N/A

1.2 REFERENCES

- A. Applicable provisions of Division 0 and Division 1 govern work under this Section.
- B. All work shall conform to the most current version of all applicable codes and standards or the version adopted by the jurisdiction.
- C. Codes
 1. International Building Code
 2. International Mechanical Code
 3. Uniform Plumbing Code
 4. International Fuel Gas Code
 5. International Fire Protection Code
 6. International Energy Conservation Code
 7. NFPA – National Fire Protection Association
 8. State or City Codes for the Spirit Lake, IA
- D. Standards
 1. FGI Guidelines for Design and Construction of Health Care Facilities
 2. ASHRAE Standard 15
 3. ASHRAE Standard 62
 4. ASHRAE Standard 90.1
 5. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc.
 6. AMCA – Air Movement and Control Association
 7. ASME – American Society of Mechanical Engineers
 8. ANSI – American National Standards Institute
 9. ARI – Air Conditioning and Refrigeration Institute
- E. Governing Bodies
 1. Owner's Insurance Company

2. State Fire Marshal
3. AHJ – Authority Having Jurisdiction
4. UL - Underwriters Laboratories
5. FM - Factory Mutual

1.3 SUBMITTALS

- A. Refer to individual technical specification sections for specific submittal requirements.
- B. Submission of shop drawings electronically in .PDF format is preferred.
- C. If hard copies of shop drawings are utilized on this project, coordinate the quantity with the Architect and General Contractor. Provide one (1) copy for the Engineer's records.
- D. The Engineer will review one resubmittal for each product. If additional resubmittals are required, the Contractor shall be responsible to bear the cost for the Engineer to recheck and handle the additional shop drawing submittals. Documents will not be reviewed until payment is agreed upon.
- E. Contractor may request electronic AutoCAD files from the Engineer if needed to complete their shop drawings. An Electronic File Request Form will be sent to the contractor if files are requested and must be completed and signed before the AutoCAD files are released to the Contractor.
- F. All submittals for equipment and materials shall be reviewed and approved by the engineer prior to the fabrication or release by the contractor. This includes fabrication drawings for ductwork and fire protection and the coordination of equipment between trades. The release, purchase, installation or fabrication of any items prior to the contractor receiving an approved shop drawing will be at the contractor's own risk. Any rework that results will be provided by the contractor at no cost to the Owner or design team.
- G. Submittals must be reviewed and approved by the Contractor before submitting to the Engineer.
- H. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified.

1.4 QUALITY ASSURANCE

- A. Warranty
 1. Equipment warranty shall be a minimum of one (1) year from date of factory supervised startup or from the date of substantial completion, whichever is later.
 2. Contractor shall warranty all of their work for one (1) year from the date of substantial completion.

B. Equipment Capacity

1. All equipment submitted shall meet or exceed the capacity listed in the specifications and schedules. This includes airflows / static pressure, heating / cooling capacities, pump flow / head, and all values listed in the construction documents.
2. All submitted motor brake horsepower's submitted shall be at least 5% less than the rated nominal motor horsepower. No motors shall be selected in the motor service factor with the exception of fire pumps.
3. The mechanical contractor shall be responsible for any structural, electrical, piping, ductwork or other utility modifications resulting from an alternate manufacturer than the basis of design being used.

C. These documents are diagrammatical in nature and intended to convey scope and general arrangement of the mechanical systems. Not all fittings, risers, size changes, offsets, valves, accessories, etc. are shown on plan. If items are required to make a system fully operational but not shown on plan or in these specifications, they shall be included by the contractor.

D. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Architect and Engineer for interpretations.

E. It is the contractor's responsibility to determine all utility routing prior to purchase and installation of material.

F. For remodel or addition projects, the contractor shall visit and survey the site prior to submitting a bid. The contractor shall visit the site to understand the complexity of utility routing, phasing, staging, and all general installation. Submitting a bid means the contractor acknowledges the complexities of the project and has made provisions for overcoming these complexities in their bid.

G. The contractor shall report any discrepancies between these documents and site conditions immediately to the Engineer prior to submitting a bid or starting work. Submittal of a bid indicates that the contractor and the contractor's subcontractors have carefully and thoroughly reviewed the drawings, specifications, and other construction documents and have found them complete and free from ambiguities and sufficient for the purposes intended.

H. Install all equipment per the manufacturer's requirements / recommendations.

I. No equipment provided or installed shall contain mercury.

J. Manufacturer Supplier Inspection & Startup

1. The following equipment shall have a factory representative perform start-up. The procedure shall be documented and submitted to the design team and Owner. Include copies of startup reports in the Operations & Maintenance Manuals.

K. All equipment shall be FM and UL listed where applicable.

1.5 ELECTRONIC DOCUMENT RELEASE

- A. Electronic versions of the bid documents will be made available to the contractors for use during the bidding process and to help generate fabrication drawings for various systems. A summary of the requirements for the various document types is listed below:
1. PDF
 - a. Contact the Construction Manager or Architect to obtain a PDF version of the Bid Documents. No Document Release Form is required.
 2. AutoCAD
 - a. KEDbluestone Engineering can provide an AutoCAD version of the bid documents for the contractor to use for generating shop drawings and fabrication drawings. This will include plan drawings with the architectural background. The contractor is responsible for incorporating any modifications that occur during bidding by all disciplines. Details and schedules will not be included.
 - b. A document release form (see attached) will be required to be completed by the contractor to determine the version of AutoCAD and drawings required. No fee is associated with these drawings.
 3. REVIT
 - a. The REVIT drawings will be converted to AutoCAD and then transferred to the contractor.
 - b. KEDbluestone Engineering can provide an AutoCAD version of the bid documents for the contractor to use for generating shop drawings and fabrication drawings. This will include plan drawings with the architectural background. The contractor is responsible for incorporating any modifications that occur during bidding by all disciplines. Details and schedules will not be included.
 - c. A document release form (see attached) will be required to be completed by the contractor to determine the version of AutoCAD and drawings required.
 - d. Submittal of the document release form will be required prior to the AutoCAD files being transmitted.

1.6 SUBSTITUTIONS

- A. All manufacturers listed as Acceptable Manufacturers in each specification section are considered equal to the basis of design. The basis of design is preferred and will take precedence. Any products from an alternate approved manufacturer need to meet the requirements and performance specified and shall be equal to the basis of design.
- B. The Contractor may request permission for a substitution of any item (equipment or material), subject to the following conditions:
1. Submit substitution requests in writing to the Engineer, on a form supplied by the Engineer. A sample copy of this form is included at the end of this section. An electronic copy can also be provided to the Contractor by the Engineer.
 2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contractor documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed as well as any re-design

costs incurred by the Architect or Engineer. The Contractor is also responsible for coordinating changes required by other trades.

3. Any requests for alternate manufacturers must be submitted to the Architect/Engineer at least ten (10) days prior to bid day. Incomplete substitution requests will not be considered.

C. Approval

1. No work involving requests for substitution shall commence without written approval on the provided form by the Engineer.
2. Any work started or material ordered/installed by the Contractor without written approval shall be removed/repared at the sole expense of the contractor. The Contractor will also be responsible for any costs incurred by the Owner for such rework.

1.7 CONTINUITY OF EXISTING SERVICES AND SYSTEMS

- A. No outages shall be permitted on existing systems except at the time and during the interval specified by the Engineer and the Owner. Any outage must be scheduled when the interruption causes the least interference with normal work schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours unless specifically noted in the Specifications or in the bidding requirements.
- B. This Contractor shall restore any mechanical services interrupted as a result of a lack of coordination to proper operation as soon as possible.
- C. Contractor shall notify Owner of any utility service shutdown forty-eight (48) hours in advance. This includes gas, water, sanitary, storm, fire protection, cooling, and heating systems.

1.8 REGULATORY AND UTILITY REQUIREMENTS

- A. Contractor is responsible for coordinating all required site inspections by authorities having jurisdiction. Contractor shall notify General Contractor of all scheduled inspections seven (7) working days prior to site visit.
- B. Contractor is responsible for paying for all fees, permits, and inspections that are required to complete their work.
- C. Contractor shall include all work required to relocate utilities and meters as shown on drawings.
- D. Contractor shall include all work required to install new utilities and meters as shown on drawings. This includes any new service and meter fees in coordination with the utility company.
- E. Utility work 5'-0" from outside of building is by others.

1.9 PROTECTION OF FINISHED SURFACES

- A. Furnish one (1) can of touch-up paint for each different color factory finish for equipment furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.10 SEALING AND FIRESTOPPING

- A. Sealing and firestopping of sleeves/openings between ducts and piping and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening . The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.11 WORK BY OWNER AND/OR OWNER AGENCY

- A. Asbestos abatement, removal and disposal, if required, will be by the Owner under separate contract.

1.12 OMISSIONS

- A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Architect and Engineer to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. All equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
- B. Store equipment indoors in clean dry space with uniform temperature to prevent condensation or damage from the elements.
- C. Take such precautions as are necessary to protect apparatus and materials from damage. Damaged equipment shall be, as determined by the Owner and/or Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
- D. Protect factory finish from damage during construction operations until acceptance of the Project. Restore any finishes that become stained or damaged to Owner's satisfaction.

1.14 DIVISION OF WORK AND COORDINATION

- A. The Electrical Contractor is responsible for providing and installing power wiring up to equipment provided by others for a single point connection. Internal wiring of equipment provided by others shall be the responsibility of the contractor responsible for providing and installing the equipment.
- B. Controls, disconnect switches, starters, variable frequency drives, etc. shall be provided and installed by the contractor noted on the plans and in the specifications. It is the responsibility of the Contractor to request written clarification for any ambiguity regarding division of work and coordination at least five (5) days prior to bid.
- C. Utilities routed within the building shall be installed in an orderly manner. All work will be coordinated with other disciplines prior to installation. The following list ranks the priority of the utilities to be installed:
 - 1. Light fixtures

2. Gravity piping
 3. Electrical busduct
 4. Ductwork
 5. Cable tray
 6. All other piping
 7. Electrical conduits
- D. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- E. Coordinate work with the Testing and Balancing (TAB) Contractor. Verify system completion to the TAB Contractor such as pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, controls adjusted and calibrated, fire/smoke damper integration ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Assist the TAB Contractor as needed to complete their work.
- F. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- H. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.15 SALVAGE MATERIALS

- A. No materials removed from this project shall be reused except as specifically noted or allowed on the Drawings. All materials removed shall become the property of, and shall be disposed of by, the Contractor except for items the Owner has designated they will keep.

1.16 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
- B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation as applicable:
1. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 2. A control sequence describing start-up, operation, and shutdown.
 3. Description of the function of each principal item of equipment.

4. Installation instructions.
5. Safety precautions for operation and maintenance.
6. Diagrams and illustrations.
7. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
8. Performance data.
9. Where applicable, pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
10. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

1.17 RECORD DRAWINGS

- A. The Contractor shall maintain at least one copy each of the Specifications and Drawings on the job site at all times.
- B. The Architect will provide the Contractor with a suitable set of Contract Drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.
- C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
- D. At completion of the project, the Contractor shall submit the marked-up record drawings to the General Contractor prior to final payment.

1.18 SPECIAL REQUIREMENTS

- A. Contractor bid shall allow color selection by Architect of any piece of exposed equipment from all available colors. Base bid color selection shall include those considered 'premium' by the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conditions: Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified.

2.2 ACCESS PANELS AND DOORS

- A. Provide access panels and/or doors where required to maintain access to the electrical installation and where noted on the Drawings.
- B. Lay-in Ceilings
 - 1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are sufficient; no additional access provisions are required unless specifically indicated.
- C. Plaster/Gypsum Walls and Ceilings
 - 1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.3 SEALING AND FIRESTOPPING

- A. Fire and/or Smoke Rated Penetrations
 - 1. Manufacturers
 - a. 3M, STI/SpecSeal, Tremco, Hilti or approved equal.
 - 2. All firestopping systems shall be by the same manufacturer.
 - 3. Submittals
 - a. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
 - 4. Product
 - a. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.
 - b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
 - c. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent fire stop collars, fire stop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
- B. Non-Rated Penetrations
 - 1. Piping Penetrations Through Below Grade Walls

- a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the piping and the cored opening or a water-stop type wall sleeve.
2. Piping and Ductwork Penetrations
 - a. At penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe/duct and sleeve or opening.

2.4 PAINT

- A. For indoor applications, use paints and primers that have a VOC content of 250 g/L or less when calculated according to the adopted version of the Green Seal Standard GC-03, Anti-Corrosive Paints.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Provide clearance for inspection, repair, replacement, and service to all equipment to include a minimum of 36 inches from all obstructions (walls, structure, ductwork, pipes, etc.). Clearance shall maintain access to all electrical panels, access doors, controllers, valves, junction boxes and operators and include the area directly in front of and above the system components.

3.2 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work to accomplish indicated mechanical systems installation in accordance with Section 312316.13 - Trenching.

3.3 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases not less than 4 inches larger in both directions than supported unit.
 2. All pads to be a minimum of 4" thick unless noted otherwise. Thicken pads as needed to accommodate the slope of slab / grade around the equipment. Exterior pads installed on grade to include frost footings. Coordinate requirements with the civil / structural designers. Refer to equipment schedules for additional requirements.

5. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
6. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
7. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
8. Install anchor bolts to elevations required for proper attachment to supported equipment.
9. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
10. Indoor or outdoor equipment meeting any or all of the following requirements shall be installed on housekeeping pads:
 - a. Floor mounted motorized equipment.
 - b. All floor or ground mounted air handling equipment and fans.
 - c. All heating, cooling, plumbing, and fire protection equipment and associated floor mounted accessories located in mechanical spaces.
 - d. Equipment installed in areas with uneven surfaces and surfaces that are not level.
 - e. As required by the equipment manufacturer
11. Refer to plans and details for additional pad locations.

3.4 PAINTING

- A. Exposed piping in occupied areas to be painted by others. Coordinate color with architect.
 1. Contractor to prep duct and piping as needed to accept paint.
- B. Contractor shall paint the following items with two (2) coats of exterior enamel over one (1) coat primer. Select paint to be compliant with material being used, i.e. metal, plastic, etc:
 1. All exposed duct, hydronic, and natural gas piping. Color to be coordinated with the Architect.

3.5 SEALING AND FIRESTOPPING

- A. Fire and/or Smoke Penetrations
 1. Install approved product in accordance with the manufacturer's instructions where a pipe/duct penetrates a fire rated surface.
 2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

B. Non-Rated Surfaces

1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
2. Install escutcheons or floor/ceiling plates where pipe/duct penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe/duct and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
4. At interior partitions, pipe/duct penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, telephone/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the sleeve and the pipe/duct is completely filled.

3.6 HOUSEKEEPING AND CLEAN UP

- A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

3.7 SITE OBSERVATIONS

- A. Site observations shall be performed by the Engineer at the following project milestones:
1. Prior to enclosure of the following areas:
 - a. Underfloor
 - b. Walls and chases
 - c. Raised floor
 - d. Above the ceiling
 2. Final project completion
- B. Contractor shall provide seven (7) working days' notice to Engineer prior to site visit.
- C. The Engineer is only responsible to conduct one (1) final site visit for each phase of the project. If upon visiting the site, the Engineer finds that not enough work is complete for the final site visit, the Contractor shall be responsible to bear the cost for the Engineer to travel to the site and revisit. Revisiting will not occur until payment is agreed upon.

3.8 EQUIPMENT STARTUP

- A. Contractor shall provide startup of equipment by factory certified personnel for equipment listed above.

- B. For all other equipment, Contractor shall perform startup per manufacturer's requirements. Startup shall be performed by personnel qualified for this work.
- C. Contractor shall test equipment to be fully functional. Test all equipment safeties and emergency stops. Test all control set-points and equipment modes.
- D. Contractor shall return to site as needed to adjust equipment for seasonal equipment performance changes.

3.9 PROJECT CLOSEOUT REQUIREMENTS

- A. Final project closeout tasks
 - 1. Deliver all spare parts listed in each specification section. Deliver to Owner chosen location.
 - 2. All equipment labeled per specifications.
 - 3. All equipment cleaned and ready for use. Install new filters in all equipment with filters; do not use Owner's spare filter sets.
- B. Contractor requirements
 - 1. Marked up drawings and specifications provided to Engineer for incorporation of as-built drawings or to serve as the as-built drawings depending on the project requirements. As-built drawings shall be clean and legible.
 - 2. Operation and Maintenance (O & M) Manuals shall include the following:
 - a. Contractor contact for warranty work
 - b. Approved shop drawings, incorporating all review comments
 - c. Warranty copies
 - d. Equipment start-up reports
 - e. Testing and balancing reports
 - f. Operation and maintenance instructions
 - 3. Three (3) final approved O & M Manuals shall be delivered to Owner. Each manual shall be an appropriately sized three (3) ring binder with a vinyl cover and printed spine and cover labels. Each section shall have a printed divider tab. Each section shall be listed in a table of contents at the beginning of the manual.

END OF SECTION

(ELECTRONIC DOCUMENT RELEASE FORM & SUBSTITUTION REQUEST FORMS ATTACHED)

Document Release Form

Information Requested:

Project Name:
Drawings Requested:

Media Type: (Check all that are applicable)

☐ AutoCAD DWG Files (Version ____)	☐ Adobe PDF Files
☐ REVIT Files (Version ____)	☐ Other

Requesting Party:

Name:	Address 1:
Company:	Address 2:
Signature:	Email Address:
Date:	Phone #:

KEDbluestone Use:

Form Sent By: _____ Date: _____

KEDbluestone Project #: _____

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SUBSTITUTION REQUEST FORM (DURING BIDDING)

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

PROJECT: _____

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

Proposed Substitution: _____

MANUFACTURER	TRADE NAME	MODEL NO.
_____	_____	_____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by the substitution.

Submitted by:

Signature

Firm

_____	Telephone
_____	Date
_____	Email

Engineer's Review and Action

- ☐ Substitution Approved
- ☐ Substitution Approved As Noted
- ☐ Substitution Rejected
- ☐ Substitution Request Received Too Late

Signed by:

Date

Supporting Data Attached:

- ☐ Drawings
- ☐ Product Data
- ☐ Samples
- ☐ Tests
- ☐ Reports
- ☐ Other _____

SECTION 23 05 13
MOTORS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following factory or field installed motors indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section
 - 1. Air Handling Units
 - 2. Fans

1.2 REFERENCES

- A. Comply with most recent edition
 - 1. NFPA 70: National Electrical Code.
 - 2. NEMA MG-1: Motors and Generators.
 - 3. Adopted version of the American Bearings Manufacturers Association, Load Ratings and Fatigue Life for Ball Bearings.
 - 4. UL 1004: Motors, Electric.

1.3 SUBMITTALS

- A. Submit for approval, the following product data:
 - 1. Manufacturer.
 - 2. Dimensions and elevations.
 - 3. Complete NEMA nameplate electrical data including design type, insulation, service factor, and efficiency.
 - 4. Materials of construction.
 - 5. Bearing type, L₁₀ life, and seal construction (open, single, or double shielded).
 - 6. Certification that VFD driven motors comply with all parts of NEMA MG-1 Part 31.

1.4 QUALITY ASSURANCE

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers for motors 1/2 HP and larger include:
 - 1. Reliance
 - 2. Baldor
 - 3. Dayton
 - 4. Toshiba
 - 5. General Electric
 - 6. U. S. Motor
 - 7. Leeson
 - 8. Marathon Electric.

2.2 MOTORS - GENERAL REQUIREMENTS

- A. Motors 1/2 HP and larger shall be three-phase, squirrel cage, induction type.
- B. Motors smaller than 1/2 HP shall be single-phase, permanent split capacitor type, with built-in overload protection.
- C. Frequency Rating: 60 Hz, alternating current.
- D. Voltage rating of motor shall be determined by voltage of circuit to which motor is connected.
- E. Motors shall be NEMA Design B.
- F. Provide Class B insulation, unless noted otherwise.
- G. Service Factor: 1.15, unless noted otherwise.

- H. Motors shall be nominal 1800 rpm, unless noted otherwise.

2.3 SINGLE PHASE MOTORS

- A. Use shaded pole motors only for motors smaller than 1/20 HP.
- B. Provide automatic reset type thermal over-load protection.
- C. Bearings: Sealed or regreasable ball or sleeve bearings, suitable for the radial and thrust loading of the application.
- D. Furnish with sliding base/slotted mounting holes adequate for proper belt tensioning and alignment of motor or motor/load.
- E. Nameplates for motors less than 1/2 HP may be printed type glued to the motor.

2.4 THREE PHASE MOTORS

- A. Enclosure: Open Drip Proof (ODP) unless otherwise noted in equipment specifications and schedules.
- B. Motor Efficiency: Nominal (nameplate) full load efficiency and corresponding minimum efficiency equal to or greater than that stated in table.*

*NEMA MG-1 TABLE 12-12 - PREMIUM EFFICIENT MOTORS NOMINAL FULL LOAD EFFICIENCIES

HP	Open drip-proof motors						Totally enclosed fan-cooled motors					
	Code			Premium			Code			Premium		
	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
1	---	82.5%	80.0%	77.0%	85.5%	82.5%	75.5%	82.5%	80.0%	77.0%	85.5%	82.5%
1.5	82.5%	84.0%	84.0%	84.0%	86.5%	86.5%	82.5%	84.0%	85.5%	84.0%	86.5%	87.5%
2	84.0%	84.0%	85.5%	85.5%	86.5%	87.5%	84.0%	84.0%	86.5%	85.5%	86.5%	88.5%
3	84.0%	86.5%	86.5%	85.5%	89.5%	88.5%	85.5%	87.5%	87.5%	86.5%	89.5%	89.5%
5	85.5%	87.5%	87.5%	86.5%	89.5%	89.5%	87.5%	87.5%	87.5%	88.5%	89.5%	89.5%
7.5	87.5%	88.5%	88.5%	88.5%	91.0%	90.2%	88.5%	89.5%	89.5%	89.5%	91.7%	91.0%
10	88.5%	89.5%	90.2%	89.5%	91.7%	91.7%	89.5%	89.5%	89.5%	90.2%	91.7%	91.0%
15	89.5%	91.0%	90.2%	90.2%	93.0%	91.7%	90.2%	91.0%	90.2%	91.0%	92.4%	91.7%
20	90.2%	91.0%	91.0%	91.0%	93.0%	92.4%	90.2%	91.0%	90.2%	91.0%	93.0%	91.7%
25	91.0%	91.7%	91.7%	91.7%	93.6%	93.0%	91.0%	92.4%	91.7%	91.7%	93.6%	93.0%
30	91.0%	92.4%	92.4%	91.7%	94.1%	93.6%	91.0%	92.4%	91.7%	91.7%	93.6%	93.0%
40	91.7%	93.0%	93.0%	92.4%	94.1%	94.1%	91.7%	93.0%	93.0%	92.4%	94.1%	94.1%

50	92.4%	93.0%	93.0%	93.0%	94.5%	94.1%	92.4%	93.0%	93.0%	93.0%	94.5%	94.1%
60	93.0%	93.6%	93.6%	93.6%	95.0%	94.5%	93.0%	93.6%	93.6%	93.6%	95.0%	94.5%
75	93.0%	94.1%	93.6%	93.6%	95.0%	94.5%	93.0%	94.1%	93.6%	93.6%	95.4%	94.5%
100	93.0%	94.1%	94.1%	93.6%	95.4%	95.0%	93.6%	94.5%	94.1%	94.1%	95.4%	95.0%
125	93.6%	94.5%	94.1%	94.1%	95.4%	95.0%	94.5%	94.5%	94.1%	95.0%	95.4%	95.0%
150	93.6%	95.0%	94.5%	94.1%	95.8%	95.4%	94.5%	95.0%	95.0%	95.0%	95.8%	95.8%
200	94.5%	95.0%	94.5%	95.0%	95.8%	95.4%	95.0%	95.0%	95.0%	95.4%	96.2%	95.8%

1. Motors less than 1 hp shall be manufacturer's standard premium efficient design.
 2. Motor nameplate shall be marked "NEMA Premium motor".
- C. Motors less than 3 HP: steel or cast iron motor frames, cast aluminum, cast iron, or steel end plates, steel or cast iron terminal box, copper windings. Motor nameplates shall be engraved type, riveted to motor.
1. Bearings: regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings, selected for a minimum L-10 bearing life of 26,280 hours (belted and direct drive).
- D. Motors 3 HP and above: cast iron motor frame and mounting feet, cast iron end plates (bells), steel or cast iron terminal box, copper windings. Motor nameplates shall be stainless steel engraved type, riveted to the motor.
1. Bearings shall be regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings. Rated for an L-10 life of 40,000 hours (belted) or 130,000 hours (direct connected).
- E. Bearing life calculations shall be per ABMA 9-1990, and for belted applications shall be based on the maximum external side load limits for belted applications per NEMA MG-1 Table 14-1A. L-10 life calculations for vertical motors and horizontal motors mounted in the vertical position shall consider the application's thrust loading.
- F. TEFC motors shall also include an external shaft slinger on drive end.
- G. Motors shall not exceed dBA levels listed in NEMA MG-1 12.54; at all speeds.
- H. Motors shall be suitable for continuous duty at rated horsepower, with temperature based on 40 deg. C ambient except as otherwise indicated.
- I. Direct connected motors shall be furnished with adjustable base. Motors connected to driven equipment by belt or shaft shall be furnished with adjustable NEMA foundation sliding bases.
- J. Multi-Speed Motors: Separate winding for each speed.

- K. For motors used with variable speed drives, motors shall be rated inverter duty and comply with all parts of NEMA MG-1 Part 31, with minimum insulation Class F and insulation temperature rise rating of Class B.
 - 1. Identify the motor as "Inverter Duty" type on the nameplate, or by engraving or stamping on motor.
- L. Motors For Use With VFD's
 - 1. Motors to be VFD rated.
 - 2. Include shaft grounding brushes or other means of protecting the motor bearings from pitting and failure caused by bearing currents.
- M. Explosion Proof Motors
 - 1. UL listed for application or duty.
 - 2. Motors shall conform to requirements defined in Article 500, 501, 502, and 503 of the National Electric Code.
 - 3. Motor nameplate shall be specifically marked "explosion proof".
 - 4. Sound power levels no greater than recommendations of NEMA MG-1 12.49.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motors shall be installed and aligned in accordance with equipment manufacturer's recommendations.
- B. Verify that bearings are lubricated. Do not over-lubricate bearings.
- C. Check motors for unusual heating, noise or excess vibration during operation. Correct any such deficiencies.
 - 1. Any motors with vibration exceeding specified limits as noted in Section 230594 - Testing, Adjusting and Balancing, or manufacturer's recommendations, whichever is more stringent, shall be corrected, at no cost to Owner, until falling below those limits.
- D. Clean motor.
- E. Assure motor nameplate is legible and properly affixed.

END OF SECTION

**SECTION 23 05 29
PIPE HANGERS AND SUPPORTS**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Pipe Hangers and Supports indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Refer to Section 230719, PIPING INSULATION for work related to this section.

1.3 SUBMITTALS

- A. Product Data
 - 1. Manufacturer's catalog sheets and specifications for hangers and supports materials.
 - 2. Installation instructions.
 - 3. Schedule indicating what type of hangers or support will be used for various piping types.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with the applicable requirements of the ASME B31 Piping Codes.
 - 2. Unless otherwise shown or specified, comply with the requirements of the Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58, and SP-69.
 - 3. Materials for use in Sprinkler Systems and Standpipe and Hose Systems shall comply with the requirements of NFPA 13 and NFPA 14 as applicable.
 - 4. Hang and support cast iron soil pipe and fittings in accordance with the recommendations of the Cast Iron Soil Pipe's Institute's (CISPI) Cast Iron Soil Pipe and Fittings Handbook.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddle with companion high density filler piece.

1. Insulating saddles and filler pieces shall be of the same thickness and materials as the adjoining pipe insulation. Saddles shall cover the lower 180 degrees of the pipe or tubing, and companion filler pieces shall cover the upper 180 degrees of the pipe or tubing. Physical sizes, gages, etc. of the components of insulated hangers shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAUGE	SADDLE LENGTH (Inches)	VAPOR BARRIER JACKET LENGTH (Inches)
Up to 2-1/2	4	16	6	10
3 to 6	4	14	6	10
8 to 14	10	12	12	16
16 and up	10	10	12	16

- B. Pipe Insulation Shields: Fabricated of steel, with a minimum arc of 180 degrees, unless otherwise indicated. Shields for use with hangers and supports, with the exception of combination clevis type hangers, shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAUGE
Up to 2-1/2	8	18
3 to 8	10	16
10 to 14	12	12
16 and up	18	10

- C. Pipe Hangers: Height adjustable standard duty clevis type, with cross bolt and nut.
 1. Pipe spreaders or spacers shall be used on cross bolts of clevis hangers, when supporting piping ten (10) inches in size and larger.
 2. Swivel ring type hangers will be allowed for sprinkler piping up to a maximum of two (2) inches in size.
- D. Adjustable Floor Rests and Base Flanges: Steel.
- E. Hanger Rods: Mild, low carbon steel, fully threaded or threaded at each end, with two (2) nuts at each end for positioning rod and hanger, and locking each in place.
- F. Riser Clamps: Malleable iron or steel.
- G. Rollers: Cast Iron.
- H. Specialty: Fasteners, supports and hangers for PEX piping shall be specifically designed for PEX piping.

2.2 ANCHORS AND ATTACHMENTS

- A. Sleeve Anchors (Group II, Type 3, Class 3): Molly's Div./USM Corp. Parasleeve Series, Ramset's Dynabolt Series, or Red Head/Phillips AN, HN, or FS Series.
- B. Wedge Anchors (Zinc Plated, Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly's Div./USM Corp. Parabolt PB Series, Ramset's Trubolt T Series, or Red Head/Phillips WS Series.

- C. Self-Drilling Anchors (Group III, Type 1): Ramset's RD Series, or Red Head/Phillips S Series.
- D. Non-Drilling Anchors (Group VIII, Type 1): Ramset's Dynaset DS Series, Hilti's HDI Series, or Red Head/Phillips J Series.
- E. Stud Anchors (Group VIII, Type 2): Red Head/Phillips JS Series.
- F. Beam Clamps: Forged steel beam clamp, with weldless eye nut (right hand thread), steel tie rod, nuts, and washers, Grinnell's Fig No. 292 (size for load, beam flange width, and rod size required).
- G. Metal Deck Ceiling Bolts: B-Line Systems' Fig. B3019.
- H. Continuous Slotted Type Concrete Insert, Galvanized.
- I. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts.
- J. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept 3/4 inch diameter bolts having special wedge shaped heads.

2.3 FASTENERS

- A. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for high humidity locations, and treated wood; plain finish for other interior locations. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work.

2.4 SHOP PAINTING AND PLATING

- A. Hangers, supports, rods, inserts and accessories used for pipe supports, unless chromium plated, cadmium plated or galvanized shall be shop coated with metal primer paint. Electroplated copper hanger rods, hangers and accessories shall be used when hangers are in direct contact with copper pipe or copper tubing.
- B. Hanger supports for chromium plated pipe shall be chromium plated brass.

2.5 ROOFTOP SUPPORT SYSTEMS

- A. Rooftop supports for piping equipment shall be provided for installation without requiring roof penetrations, flashing, or damage to the roofing material. Height-adjustable supports may be used where necessary. Support piping a minimum of 4" above the roof surface.
- B. Materials:
 - 1. Support bases shall be made of an engineered material with appropriate additives for UV protection. All structural steel components shall be hot-dipped galvanized.
 - 2. The support shall have a continuous bottom surface to provide even load distribution and minimize point loading of the roof membrane. The support base will have a radiused edge to enhance compatibility with roof membranes.

3. Coordinate static load rating of the support(s) with the specific application being served.
4. Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system.

C. Applications:

1. Fixed Strut Pipe Hanger Supports: Size and load ratings for the application
2. Adjustable Strut Pipe Hanger Supports: Height adjustable, size and load ratings for the application
3. Adjustable Single Piping Supports: Height adjustable, size and load ratings for the application
4. Block Supports: Size and load ratings for the application
5. Roller Supports: Height adjustable, size and load ratings for the application
6. Bridge Assemblies:
 - a. Suitable for multiple piping runs or equipment
 - b. Size and load ratings for the application
7. Post Base Assemblies:
 - a. For use with vertical sections of channel support systems
 - b. Size, channel support configuration, and load ratings for the application

D. Acceptable Manufacturers:

1. Caddy/Pentair
2. Cooper B-Line
3. Mifab, Arlington
4. Rooftop Blox
5. Haydon
6. MAPA Products
7. Miro Industries

PART 3 - EXECUTION

3.1 PREPARATORY WORK

- A. Place inserts into construction form work expeditiously, so as not to delay the work of other trades.

3.2 INSTALLATION

- A. Do not hang or support one (1) pipe from another or from ductwork.
- B. Do not bend threaded rod.
- C. Do not hang or support equipment from the bottom chord of joists.
- D. Support all insulated horizontal piping conveying fluids below ambient temperature, by means of hangers or supports with insulation shields installed outside of the insulation.
- E. Space hangers or supports for horizontal piping on maximum center distances as listed in the documents, and as follows.
 - 1. Cast Iron Soil Pipe:
 - a. General:
 - 1) Where piping is suspended on centers in excess of 18 inches by means of non-rigid hangers, provide sway bracing to prevent horizontal pipe movement.
 - 2) Additionally, brace piping five (5) inches and larger to prevent horizontal movement and/or joint separation. Provide braces, blocks, rodding or other suitable method at each branch opening, or change of direction
 - b. For Bell & Spigot Cast Iron Soil Pipe: Space hangers or support pipe at each joint or on maximum centers of five (5) feet. Place hangers or supports as close as possible to joints and when hangers or supports do not come within one (1) foot of a branch line fitting, install an additional hanger or support at the fitting.
 - c. For Hubless Cast Iron Soil Pipe: Space hangers or support pipe at each joint or on maximum centers of five (5) feet. Place hanger or supports as close as possible to joints and when hangers or supports do not come within one (1) foot of a branch line fitting, install an additional hanger or support at the fitting.
 - 2. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
 - 3. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
 - 4. For Branch Piping Runs and Runouts Over 5 feet In Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
 - 5. Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be used. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

- F. Size hanger rods in accordance with the following:

PIPE SIZE (Inches)	SINGLE ROD HANGER SIZE (Inches)		DOUBLE ROD HANGER SIZE (Inches)	
	PIPE	TUBING	PIPE	TUBING
1/2 to 2	3/8	1/4	3/8	1/4
2-1/2 and 3	1/2	3/8	3/8	1/4
4 and 5	5/8	1/2	1/2	3/8
6	3/4	1/2	5/8	1/2
8, 10 and 12	7/8	5/8	3/4	5/8

- Secure hanger rods as follows: Install one (1) nut under clevis, angle or steel member; one (1) nut on top of clevis, angle or steel member; one (1) nut inside insert or on top of upper hanger attachment and one (1) nut and washer against insert or on lower side of upper hanger attachment. A total of four (4) nuts are required for each rod, two (2) at upper hanger attachment and two (2) at hanger.
- Size hanger rods, for piping over 12 inches in size and multiple line supports, based on a safety factor of five for the ultimate strength of the materials being used.

- G. Vertical Piping

- Support vertical risers of piping systems, by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs. Provide adequate clearances for risers that are subject to appreciable expansion and contraction, caused by operating temperature ranges.
- Support extension arms of riser clamps, secured to risers to be insulated for cold service, 4 inches above floor slabs, to allow room for insulating and vapor sealing around riser clamps.
- Support cast iron risers, by means of heavy duty hangers installed close to the base of the pipe risers, and 1/4 inch thick malleable iron or steel riser clamps with extension arms at each floor level, with the distance between clamps not to exceed 25 feet. Support cast iron risers in vertical shafts equivalent to the aforementioned.
- Support hubless cast iron risers, by means of heavy duty hangers installed close to the base of the pipe risers, and by malleable iron or steel riser clamps with the extension arms at each floor level, with the distance between clamps or intermediate supports not to exceed 12 feet. Support risers in vertical shafts equivalent to the aforementioned.

- H. Floor Supports: Install adjustable yoke rests with base flanges, for the support of piping, unless otherwise indicated on the Drawings. Install supports in a manner, which will not be detrimental to the building structure.
- I. Underground Cast Iron Pipe Supports: Firmly bed pipe laid underground, on solid ground along bottom of pipe. Install masonry piers for pipe laid in disturbed or excavated soil or where suitable bearing cannot be obtained. Support pipe, laid proximate to building walls in disturbed or excavated soil, or where suitable bearing cannot be obtained, by means of wall brackets or hold-fasts secured to walls in an approved manner.

3.3 UPPER HANGER ATTACHMENTS

A. General

1. Secure upper hanger attachments to overhead structural steel, steel bar joists, or other suitable structural members.
2. Do not attach hangers to steel decks that are not to receive concrete fill.
3. Do not attach hangers to precast concrete plank decks less than 2-3/4 inches thick.
4. Do not use flat bars or bent rods as upper hanger attachments.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by pipe support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of five.

1. Do not use drive-on beam clamps.
2. Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.
3. Do not drill holes in main structural steel members.
4. Beam clamps, with tie rods as specified, may be used as upper hanger attachments for the support of piping, subject to clamp manufacturer's recommended limits.

C. Attachment to Concrete Filled Steel Decks

1. New Construction: Install metal deck ceiling bolts.
2. Existing Construction: Install welding studs (except at roof decks). Do not support a load in excess of 250 lbs from any single welded stud.
3. Do not attach hangers to decks less than 2-1/2 inches thick.

D. Attachment to Cast-In-Place Concrete: Secure to overhead construction by means of cast-in-place concrete inserts.

E. Attachment to Existing Cast-In-Place Concrete

1. For piping up to a maximum of 4 inches in size, secure hangers to overhead construction with self-drilling type expansion shields and machine bolts.
2. Secure hangers to wall or floor construction with single unit expansion shields or self-drilling type expansion shields and machine bolts.

F. Attachment to Cored Precast Concrete Decks: Toggle bolts may be installed in cells for the support of piping up to a maximum of 2-1/2 inches in size.

G. Attachment to Hollow Block or Hollow Tile Filled Concrete Decks

1. New Construction: Omit block or tile and pour solid concrete with cast-in-place inserts.

2. Existing Construction: Break out block or tile to access, and install machine bolt anchors at highest practical point on side of web.

H. Attachment to Waffle Type Concrete Decks

1. New Construction: Install cast-in-place inserts.
2. Existing Construction: Install machine bolt expansion anchors at highest practical point on side of web.

I. Attachment to Precast Concrete Tee Construction

1. New Construction: Tee hanger inserts between adjacent flanges, except at roof deck without concrete fill.
2. Existing Construction: Dual unit expansion shields in webs of tees. Install shields as high as possible in the webs.
 - a. Exercise extreme care in the field drilling of holes to avoid damage to reinforcing.
 - b. Do not use powder driven fasteners.

J. Attachment to Wood Construction: Secure hangers to the sides (only) of wood members, by means of malleable iron side beam connectors, or malleable iron or steel side beam brackets. Do not secure hanger attachments to nailing strips resting on top of steel beams.

1. Secure side beam connectors to wood members with two (2) No.18 x 1-1/2 inch long wood screws, or two (2) No.16 x 1-1/2 inch long drive screws. Do not support piping over 1-1/2 inches in size from side beam connectors. Do not hammer in wood screws.
2. Secure side beam brackets to wood members with steel bolts or lag screws. Do not use lag screws in wooden members having a nominal thickness (beam face) under two (2) inches in size. Install bolts or lag screws, in the sides of a timber or a joist, at the mid-point or above, not less than 2-1/2 inches from the lower edge when supporting branch lines and not less than three (3) inches from the lower edge when supporting mains. Install heavy gauge steel washers under all nuts.
3. Secure side beam brackets to wooden beams or joists, with lag screws or bolts of size as follows:

PIPE SIZE (Inches)	LAG SCREW SIZE (Inches)	BOLT DIAMETER (Inches)
2 and under	3/8 diameter x 1-3/4	3/8
2-1/2 and 3	1/2 diameter x 2	1/2
4 and 5	Use Bolt	5/8

- a. Do not support piping larger than 3 inches with lag screws. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.
- b. The minimum width of the lower face of wood beams or joints in which lag screws of size as specified may be used is as follows:

LAG SCREW DIAMETER (Inches)	NOMINAL WIDTH OF BEAM FACE (Inches)
3/8	2
1/2	3

4. Do not secure hanger attachment to the diagonals or vertical members of the trusses.

3.4 ANCHORS, RESTRAINTS, RIGID SUPPORTS, STAYS AND SWAY BRACES

- A. Install pipe anchors, restraints and sway braces, at locations noted on the Drawings. Design anchors so as to permit piping to expand and contract freely in opposite directions, away from anchor points. Install anchors independent of all hangers and supports, and in a manner that will not affect the structural integrity of the building.
- B. Cast Iron Soil Piping Systems
 1. Where piping is suspended on centers in excess of 18 inches by means of non-rigid hangers, provide sway braces, of design, number and location in accordance with the Cast Iron Soil Pipe Institute's Cast Iron Soil Pipe and Fittings Handbook to prevent horizontal pipe movement.
 2. Additionally, brace piping five (5) inches and larger to prevent horizontal movement and/or joint separation. Provide braces, blocks, rodding or other suitable method at each branch opening, or change of direction in accordance with the Cast Iron Soil Pipe Institute's Cast Iron Soil Pipe and Fittings Handbook to prevent horizontal pipe movement.

3.5 COMBINATION CLEVIS HANGER, PIPE INSULATION SHIELD AND VAPOR BARRIER JACKETED HIGH DENSITY INSULATING SADDLES

- A. Install a combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddles, at all points of support for piping or tubing to be insulated for cold service. Furnish companion high density vapor barrier jacketed saddle pieces, of the same material, thickness and length, for installation over the top 180 degree surface of pipe or tubing, at each point of support where an insulated clevis hanger is utilized.

3.6 PIPE INSULATION SHIELDS

- A. Unless otherwise specified, install a pipe insulation shield, at all points of support. Center shields on all hangers and supports outside of high density insulation insert, and install in such a manner so as not to cut, or puncture jacket.

END OF SECTION

**SECTION 23 05 53
MECHANICAL IDENTIFICATION**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Equipment Identification indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Items to be labeled
 - 1. Plumbing and Piping Valves
 - 2. Piping
 - 3. Equipment (Including but not limited to the following)
 - a. Air Handling Units (AHU, RTU, ERU, Blower Coil, Makeup Air Units)
 - b. Fans
 - c. Terminal Devices (TAB, Heat Pumps, Fan Coil, Cabinet Heater, Unit Heater)
 - d. Condensing Units
 - e. Dedicated equipment control panels (sump pumps, sewage ejectors, radiant infloor heat zones)
 - 4. Thermostats

1.2 REFERENCES

- A. ANSI A13.1 - Scheme for Identification of Piping Systems.

1.3 SUBMITTALS

- A. Product Data
 - 1. Manufacturer's catalog sheets and specifications for mechanical identification materials.
 - 2. Installation instructions.
 - 3. Schedule indicating what type of materials will be used for various equipment, valves, piping, and devices.

PART 2 - PRODUCTS

2.1 EQUIPMENT TAGS

- A. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

- B. Plastic Tags: 1/16" thick, UV resistant phenolic plastic. Minimum 1-1/2" square or round laminated with engraved, 1/4" minimum black letters on light contrasting background.
- C. Tags shall be black with white lettering.
- D. Lettering: Lettering shall be supplier's normal font, minimum 1" high

2.2 VALVE TAGS

- A. Brass Tags: 1-1/2" Round 19 gauge brass tags with 1/4" minimum engraved letters.
- B. Plastic Tags: 1/16" thick, UV resistant phenolic plastic. 1-1/2" round laminated with engraved, 1/4" minimum black letters on light contrasting background.
- C. Tags shall be brass or white with solid black lettering.
- D. Provide with brass ball chain or plastic zip connectors to attach tag to valve

2.3 PIPE MARKERS AND ACCESSORIES

- A. Snap-on Marker: One (1) piece wrap around type constructed of pre-coiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, 3/4 inch adhesive strip on inside edge, and 360 degree visibility.
- B. Strap-On Marker: Strip type constructed of pre-coiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, factory applied grommets, and pair of stainless steel spring fasteners.
- C. Stick-On Marker: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, and integral flow arrows for applications where flow arrow banding tape is not being used.
- D. Underground Marker: 6" wide, thickness depends on type. Detectable or non-detectable is acceptable. Provide detectable type for non-metallic piping such as plastic gas, water main, or underground PVC piping.
- E. Pipe Marker Legend and Color Field Sizes:

OUTSIDE DIAMETER OF PIPE OR INSULATION (Inches)	LETTER SIZE (Inches)	LENGTH OF COLOR FIELD (Inches)
3/4 to 1-1/4	1/2	8
1-1/2 to 2	3/4	8
2-1/2 to 6	1-1/4	12
8 to 10	2-1/2	24
Over 10	3-1/2	32

- F. Banding Tapes: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating.
 - 1. Plain Tape: Unprinted type; color to match pipe marker background.

2. Flow Arrow Tape: Printed type with integral flow arrows; color to match pipe marker background.
- G. Pipe Size Labels: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, vertical reading pipe size in inches, and legend size matching adjacent pipe marker.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Complete testing, insulation and finish painting work prior to completing the Work of this Section.
- B. Clean pipe surfaces with cleaning solvents prior to installing piping identification.
- C. Remove dust from insulation surfaces with clean cloths prior to installing piping identification.

3.2 PIPING IDENTIFICATION

- A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.
- B. Stick-On Pipe Markers:
 1. Install minimum of two (2) markers at each specified location, 90 degrees apart on visible side of pipe.
 2. Encircle ends of pipe markers around pipe or insulation with banding tape with one inch lap. Use plain banding tape on markers with integral flow arrows, and flow arrow banding tape on markers without integral flow arrows.
- C. Pipe Size Labels: Install labels adjacent to each pipe marker and upstream from flow arrow. Install a minimum of two (2) pipe size labels at each specified location, 90 degrees apart on visible side of pipe.
- D. Underground Pipe Markers: Install 8-12" above buried piping. Install along entire length of pipe.

3.3 PIPING IDENTIFICATION SCHEDULE

- A. Piping Identification Types

Piping:	Field Color:	Lettering Color:
Domestic Water	Green	White
Sanitary, Vent, Condensate, Drain	Green	White
Natural Gas	Yellow	Black

B. Locate piping identification as follows:

1. Locate piping identification at valve locations; at points where piping enters and leaves a partition, wall, floor or ceiling, and at intervals of 20 feet on straight runs.
2. Where two (2) or more pipes run in parallel, place printed legend and other markers in same relative location.

3.4 EQUIPMENT IDENTIFICATION

- A. Install engraved tags on equipment using metal rivets or stainless steel sheet metal screws with a pan head. For indoor equipment, industrial strength double-sided tape is acceptable if rivets or screws cannot be used. Install label on most visible side of equipment. Place identification along center line of equipment, if possible.
- B. Label all mechanical equipment using the same callout as used on the drawings, by means of engraved tags.
- C. Label all fire, fire/smoke, and smoke dampers with adhesive labels or permanent nameplates. Labels shall read "Fire Damper", "Fire/Smoke Damper", or "Smoke Damper" to match damper type.
- D. Do not label equipment in exposed public spaces, e.g. cabinet unit heaters, diffusers, louvers, etc.
- E. Label hidden equipment such as sump pumps on the control panel or disconnect if it does not make sense to label the equipment itself.
- F. Label thermostats with the corresponding terminal air box or equipment served.

3.5 VALVE TAGS

- A. Valve tags shall be engraved with the following information:
 1. Service Abbreviation
 2. Valve number
- B. Service Abbreviation shall match piping nomenclature used on Drawings.
- C. Attach tags to valves, not valve handles or wheels.
- D. Trim excess from connecting strip or chain.
- E. Valve Schedule
 1. Provide a valve schedule that lists all valves not installed for individual plumbing fixtures. Valve schedule shall list the following information in order: service, tag number, size, usage (shut-off, balancing, control, etc.), name and number or room location, normally open or closed, pressure rating, manufacturer, model number, and installation date.
 2. Provide three (3) laminated hard copies and one (1) electronic copy in .pdf format. Hard copies shall be clearly legible and a minimum of 11" x 17".

3. Mount one (1) of the hard copies in a solid metal frame in a location designated by the Owner.

3.6 SPECIAL CONDITIONS

- A. Additional labels shall be installed at the request of the Engineer/Owner.

END OF SECTION

SECTION 23 05 93 CLEANING AND TESTING

PART 1 - GENERAL

1.1 SCOPE

- A. Cleaning of systems to remove construction debris and prepare for testing and operation.
- B. Perform testing on systems and equipment to confirm they can withstand normal operating and design conditions as outlined in various equipment sections.
- C. Equipment Included in This Section
 - 1. Natural gas piping
 - 2. Domestic water piping

1.2 REFERENCES

- A. Balancing of Systems: Section 230594.

1.3 SUBMITTALS

- A. Quality Control Submittals
 - 1. Submit Field Test Reports for all systems to be tested.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Perform factory testing of factory fabricated equipment in complete accordance with the agencies having jurisdiction.
 - 2. Perform field testing of piping systems in complete accordance with the local utilities and other agencies having jurisdiction and as specified.

1.5 PROJECT CONDITIONS

- A. Protection: During test Work, protect controls, gages and accessories which are not designed to withstand test pressures. Do not utilize permanently installed gauges for field testing of systems.

1.6 SEQUENCING AND SCHEDULING

- A. Transmit written notification of proposed date and time of operational tests to the Architect / Engineer at least five (5) days in advance of such tests.

- B. Perform cleaning and testing Work in the presence of the Owner's Representative.
- C. Pressure test piping systems inside buildings, at the roughing-in stage of installation, before piping is enclosed by construction Work, and at other times as directed. Perform test operations in sections as required and directed, to progress the Work in a satisfactory manner and not delay the general construction of the building. Valve or cap-off sections of piping to be tested, utilizing valves required to be installed in the permanent piping systems or temporary valves or caps as required to perform the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Test Equipment and Instruments: Type and kind as required for the particular system under test.
- B. Test Media (air, gas, refrigerant, dry nitrogen, vacuum, water): As specified for the particular piping or system under test.
- C. Cleaning Agent (chemical solution, steam, water): As specified for the particular piping, apparatus or system being cleaned.
- D. Propylene Glycol: Permanent type anti-freeze solution as manufactured by Dow Chemical Co. or Union Carbide.

PART 3 - EXECUTION

3.1 PRELIMINARY WORK

- A. Thoroughly clean pipe and tubing prior to installation. During installation, prevent foreign matter from entering systems. Prevent if possible and remove stoppages or obstructions from piping and systems.
- B. Thoroughly clean compressed air, control air, refrigerant pipe and similar systems prior to pressure or vacuum testing.
 - 1. Refrigerant Piping
 - a. Only use factory sealed refrigerant piping.
 - b. Crimp and braze caps on ends of previously cleaned piping at the end of the day if piping was cut.
 - c. When brazing, purge lines with dry nitrogen.

3.2 PRESSURE TESTING OF PIPING

- A. Piping shall be tight under test and shall not show loss in pressure or visible leaks, during test operations or after the minimum duration of time as specified. Remove piping which is not tight under test; remake joints and repeat test until no leaks occur.

B. Water Systems

1. Domestic water (potable cold, domestic hot and recirculation) inside buildings:
 - a. Before fixtures, faucets, trim and accessories are connected, perform hydrostatic test at 125 psig minimum for four (4) hours.
 - b. After fixtures, faucets, trim and accessories are connected, perform hydrostatic retest at 75 psig for four (4) hours.

- C. Gas Piping: Before backfilling or concealment perform air test of duration and pressure as required by the local gas company. However, for gas piping designed for pressures of from 4 inches to 6 inches water column, air test at 15 inches Hg for one (1) hour, without drop in pressure. Test gas piping with air only. Check joints for leaks with soap suds.

3.3 TESTING OF EQUIPMENT, APPARATUS AND APPURTENANCES

- A. Relief Valves: Increase pressure in equipment or apparatus to relief valve setting, to test opening of valves at required relief pressures.

3.4 DISINFECTION OF POTABLE WATER SYSTEMS

- A. Disinfect potable water pipe and equipment installed in the Work of this Contract.
1. Completely fill the piping, including water storage equipment if installed, with a water solution containing 50 mg/L available chlorine, and allow stand for twenty-four (24) hours.
 2. Operate all valves during this period to assure their proper disinfection.
 3. After the retention period, discharge the solution to an approved waste and flush the system thoroughly with water until substantially all traces of chlorine are removed.
 4. Drain and flush water storage equipment if installed.
- B. Connect plumbing fixtures and equipment and place the system into service. Prevent recontamination of the piping during this phase of the Work.

END OF SECTION

SECTION 23 05 94
TESTING ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required for complete Testing, Adjusting and Balancing of the systems as indicated by the Contract Documents with supplementary items necessary for proper system operation.
- B. Equipment included in This Section
 - 1. Air Handling Equipment
 - a. Air handling units
 - b. Energy recovery units
 - c. Exhaust fans
 - d. Air inlets and outlets

1.2 SUBMITTALS

- A. Certified TAB reports

1.3 QUALITY ASSURANCES

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB, or TABB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB, or TABB as a TAB technician.

1.4 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.5 PROJECT CONDITION

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations

1.6 COORDINATION

- A. Notice: Provide seven (7) days advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

1.7 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
 - 2. Air Outlets and Inlets: Plus or minus 10 percent
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent
 - 4. Cooling-Water Flow Rate: Plus or minus 10 percent

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one (1) of the following
 - 1. Precision Facility Solutions
 - 2. System Management and Balance
 - 3. System Works

3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ductwork" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design". Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.

- B. Complete system-readiness checks and prepare reports. Verify the following:
1. Permanent electrical-power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.
 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in this specification and one of the following:
1. AABC's "National Standards for Total System Balance"
 2. ASHRAE 111
 3. NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems"
 4. SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing"
- B. Comply with requirements of the adopted version of ASHRAE 62.1, Section on balancing.
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation".
- D. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- E. Take and report testing and balancing measurements in inch-pound (IP).

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. For variable-air-volume systems, develop a plan to simulate diversity.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ductwork."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - 2. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow
 - 3. Measure fan static pressures as follows to determine actual static pressure:
 - 4. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - 5. Measure static pressure a few feet downstream of a fan or in a location that will avoid turbulent or unrepeatable performance.
 - 6. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - 7. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 8. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

9. Report the cleanliness status of filters and the time static pressures are measured.
 10. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 11. Balancer can adjust fan speeds 15% higher or lower than speed indicated in the approved shop drawing to meet the required capacity. If a fan needs to operate outside these parameters to meet the capacity requirements, balancer to contact the Engineer for approval. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance
 12. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of sub-main and branch ducts.
 2. Where sufficient space in sub-main and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 3. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 4. Re-measure each sub-main and branch duct after all have been adjusted. Continue to adjust sub-main and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data
 2. Airflow
 3. Entering- and leaving-air temperature at full load
 4. Voltage and amperage input of each phase at full load and at each incremental stage
 5. Calculated kilowatt at full load
 6. Fuse or circuit-breaker rating for overload protection
- B. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air
 2. Wet-bulb temperature of entering and leaving air
 3. Airflow
 4. Air pressure drop

3.10 FINAL REPORT

- A. General: Prepare a certified written report;
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves
 - 2. Fan curves
 - 3. Manufacturers' test data
 - 4. Field test reports prepared by system and equipment installers
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page
 - 2. Name and address of the TAB contractor
 - 3. Project name
 - 4. Project location
 - 5. Architect's name and address
 - 6. Engineer's name and address
 - 7. Contractor's name and address
 - 8. Report date
 - 9. Signature of TAB supervisor who certifies the report
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - d. Nomenclature sheets for each item of equipment.
 - e. Data for terminal units, including manufacturer's name, type, size, and fittings.

- f. Notes to explain why certain final data in the body of reports vary from indicated values.
- 12. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Settings for supply-air, static-pressure controller.
 - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outdoor, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.

3.11 INSPECTIONS

- A. Initial Inspection
 - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 - 2. Check the following for each system:
 - a. Measure airflow of at least ten (10) percent of air outlets.
 - b. Measure water flow of at least five (5) percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection
 - 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Construction Manager.

2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
 3. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal eight (8)-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than ten (10) percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within ninety (90) days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

**SECTION 23 07 13
DUCTWORK INSULATION**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Ductwork Insulation indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section
 - 1. Insulation
 - 2. Fasteners
 - 3. Jacketing
 - 4. Sealants

1.2 REFERENCES

- A. Ductwork schedules located on Drawings.
- B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed in the following references:
 - 1. NFPA 90
 - 2. ASTM
- C. Abbreviations
 - 1. K: Thermal Conductivity, in Btu per inch thickness per hour per square foot.
 - 2. PVC: Polyvinylchloride

1.3 SUBMITTALS

- A. Product Data
 - 1. Manufacturer's catalog sheets and specifications for insulation materials and jacket materials.
 - 2. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate option selected. Schedule should be similar to Ductwork schedule on Drawings.

1.4 QUALITY ASSURANCE

- A. Qualifications: The persons installing the Work of this Section and their Supervisor shall be personally experienced in mechanical insulation work and shall have been regularly employed by a company installing mechanical insulation for a minimum of five (5) years.
- B. Regulatory Requirements
 - 1. Insulation installed inside buildings, including duct lining materials, laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

PART 2 - PRODUCTS

2.1 ADHESIVES

- A. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Calcium Silicate Adhesive: fibrous, sodium-silicate-based adhesive with a service temperature range of 50° F - 800° F (10° C - 427° C).
- C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of -75° F to +300° F (-59° C to +149° C).
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, class 2, Grade A.
- F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.2 MASTICS

- A. For indoor applications, use mastics that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

2.3 LAGGING ADHESIVES

- A. For indoor applications, use adhesive that has a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

2.4 JACKETS

A. PVC Jackets

1. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness: 0.030".
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White

B. Stainless Steel Jackets:

1. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
2. Type 304 or Type 316 sheet and roll stock ready for shop or field sizing. Material thickness: 0.030".
3. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and 2.5mil- thick polysurlyn.

C. Aluminum Jackets:

1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
2. Moisture Barrier for Outdoor Applications: 3-mil thick, heat-bonded polyethylene.

D. Self-Adhesive Outdoor Jackets:

1. Self-Adhesive Outdoor Jacket: 60-mil thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.5 BANDING

- A. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316 as required to match jacketing material; 0.015 inch thick, 3/4 inch wide with wing seals.
- B. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seals.

2.6 SEALANTS

- A. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 INSULATION

A. Ductwork Insulation Types

1. Type A: Flexible fiberglass duct wrap. Minimum density 0.75 #/ft³, K of 0.30 at 75° F; ASTM C 553, Type II.
2. Type B: Semi-rigid fiberglass board wrap. Minimum density 3.0 #/ft³, K of 0.23 at 75° F; ASTM C612, Type IA.
3. Type C: Flexible fiberglass duct liner. Minimum density 3.0 #/ft³, K of 0.24 at 75° F; ASTM C 1071. Liner between insulation and airstream side of double-wall ductwork shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.
4. Type D: Preformed rigid fiberglass duct liner. Minimum density 3.0 #/ft³, K of 0.23 at 75°F; ASTM C 1071. Liner shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84
5. Type E: Flexible mineral fiber duct wrap (Suitable for Temperatures Up to 1800° F). Minimum density 6 #/ft³; ASTM E 2336, NFPA 96-2011, UL 1978 (Rev. 6-02). Two (2)-hour fire separation rating with zero clearance to combustibles. Thickness shall be as specified or as required by AHJ to meet fire separation requirements.
6. Type F: Flexible fiberglass duct liner for spiral ductwork. Minimum density 3.0 #/ft³, K of 0.23 at 75° F; Liner shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

B. Fire resistant, anti-erosion, and anti-microbial coating on lining interior to duct; NFPA 90-A and 90-B.

- C. All insulation densities listed are minimum densities. Contractor shall be responsible for verifying the required insulation thickness & density to meet the minimum installed insulation R-values as listed in the ductwork schedules on the drawings.

PART 3 - EXECUTION

3.1 DUCT INSULATION SCHEDULE

- A. Refer to Ductwork Application Schedule on Drawings for insulation requirements.

3.2 PREPARATION

- A. Perform the following before starting insulation work.

1. Install hangers, supports and appurtenances in their permanent locations.

2. Complete testing of piping, ductwork, and equipment.
3. Clean and dry surfaces to be insulated.

3.3 INSTALLATION, GENERAL

- A. Install the work of this section in accordance with the manufacturer's printed installation instructions unless otherwise specified.

3.4 INSTALLATION AT HANGERS AND SUPPORTS

- A. Reset and realign hangers and supports if they are displaced while installing insulation.
- B. Insulation inserts for use with fibrous glass insulation:
 1. Ductwork: Install 6 #/ft³ density jacketed fibrous glass board, same thickness as adjoining insulation, sized for full bearing on supporting trapeze member, and as required to enable abutting to adjoining insulation and overlapping of jacketing.

3.5 INSTALLATION OF DUCTWORK INSULATION

- A. Exterior to Ductwork
 1. Cut insulation to stretch-out dimensions as recommended by insulation manufacturer.
 2. Remove two (2) inch wide strip of insulation material from the jacketing on the longitudinal and circumferential joint edges to form an overlapping staple/tape flap.
 3. Install insulation with jacketing outside so staple/tape flap overlaps insulation and jacketing on other end.
 4. Butt ends of insulation tightly together.
 - a. Rectangular and Square Ductwork: Do not compress insulation at duct corners.
 5. Staple longitudinal and circumferential joints with outward clinching staples minimum six (6) inches on center, and seal with pressure sensitive sealing tape.
 6. Cut off protruding ends of fasteners flush with insulation surface and seal with pressure sensitive sealing tape.
 7. Install duct insulation fasteners on bottom side of horizontal duct runs, when bottom dimension of the duct is in excess of 24 inches in width.
 8. Install duct insulation fasteners on sides of duct risers having a dimension over 24 inches in size.
 9. Seal tears, punctures, and penetrations of insulation jacketing with sealing tape.

B. Interior to Ductwork

1. Insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment or other ductwork, which will not permit adequate space for installation of insulation after ducts are installed.
2. Line interior surfaces of ducts with thermal and acoustic board insulation, when the specified application of exterior insulation is impractical.
 - a. Written permission from the Engineer must be received, prior to the substitution of lined ducts for exterior insulated ducts.
 - b. Maintain interior cross-sectional areas of ducts, as noted on drawings.

3.6 INSTALLATION OF JACKETING MATERIAL

A. PVC Jackets:

1. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
2. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Metal Jackets:

1. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIELD QUALITY CONTROL

- A. Field Samples: The Director's Representative, may at his discretion, take field samples of installed insulation for the purpose of checking materials and application. Reinsulate sample cut areas.

3.8 DUCTWORK SERVICE INSULATION SCHEDULE

- A. Insulate all ductwork except where otherwise specified. See Ductwork schedule on Drawings.

B. Notes

1. Equipment: Insulate air handling equipment, not furnished with factory applied insulated jacket or internal insulation, with minimum 1-1/2 inch thick fibrous glass board with an ASTM C 1136 Type I jacket, installed and finished as specified for exposed ductwork in finished spaces.

END OF SECTION

**SECTION 23 11 26
NATURAL GAS PIPING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following Natural gas Piping System indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section
 - 1. Piping
 - 2. Regulators
 - 3. Unions
 - 4. Valves

1.2 REFERENCES

- A. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. Adopted version of the International Fuel Gas Code.
 - 2. Adopted version of NFPA 54, National Fuel Gas Code.
 - 3. ASME as it pertains to the welding of piping.
 - 4. State Boiler Code

1.3 SUBMITTALS

- A. Product Data
 - 1. Catalog sheets and specifications indicating manufacturer name, type, applicable reference standard, schedule, or class for specified pipe and fittings.
 - 2. Material Schedule: Itemize pipe and fitting materials for each specified application in Pipe and Fittings Schedule in Part 3 of this Section. Where optional materials are specified indicate option selected.
- B. Submit piping layout drawings as per Section 230500.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and Work shall meet or exceed all applicable federal, state and local requirements and conform to codes and ordinances of authorities having jurisdiction.
- B. Valves: Manufacturer's name, size, standards compliance and pressure rating clearly marked on outside of valve body.
- C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- E. Installer Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years documented experience. All installation shall be supervised by a licensed Master Plumber. All testing shall be performed by a licensed Journeyman or Master Plumber. Welders shall be certified in accordance with ASME.

1.5 EXTRA MATERIALS

- A. Provide one (1) plug valve wrench for every ten (10) plug valves sized 2 inches and smaller, minimum of one (1). Provide each plug valve sized 2-1/2 inches and larger with a wrench incorporating a setscrew.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Natural gas pressures shall not exceed two (2) pounds per square inch gauge on customer side of the meter.
- C. Pipe joint compound shall be lead-free, non-toxic, non-hardening, insoluble in the presence of natural gas and compliant with ANSI/NSF 61 and Federal Specification TT-S-1732. Temperature service range of -15° F to +400° F.

2.2 PIPING

- A. Polyethylene Piping
 - 1. Polyethylene, SDR-11, ASTM D2513 pipe and fittings with heat fusion socket joints.
 - 2. Polyethylene pipe and fitting materials shall be compatible and by same manufacturer to ensure uniform melting and a proper bond. Fabricated fittings shall not be used.
 - 3. Provide connection between buried plastic gas service piping and metallic riser in accordance with the gas code. Provide metallic riser consisting of HDPE fused coating on steel pipe for connection to above ground building distribution piping. Underground

horizontal metallic portion of riser shall be at least twenty four (24) inches in length before connecting to the plastic service pipe. An approved transition fitting or adaptor meeting design pressure rating and plastic pipe manufacturers recommendations shall be used where the plastic joins the metallic riser.

B. Steel Piping

1. Schedule 40 black steel, ASTM A53, Grade A or B, seamless or electric resistance welded.
 - a. Malleable Iron, Steam Pattern Threaded Fittings
 - 1) 150 lb Class: ASME B16.3
 - b. Schedule 40 Carbon Steel Fittings
 - 1) ASME B16.9

C. Corrugated Stainless Steel Tubing (CSST) & Fittings

1. Tubing shall be made from 300 series stainless steel strip conforming to ASTM A240 & shall be suitable for operation with fuel gases.
2. Tubing shall be rated for a minimum of 25 PSI operating pressure.
3. Tubing come with a factory installed, integral polyethylene sleeve. The polyethylene sleeve shall have internal vent channels lengthwise to direct any leakage along the pipe to the end fittings. The construction of the pre-sleeved system shall provide the code required encasement & venting capabilities of the system.
4. All fittings shall be non-gasketed, CSA International listed for installation in concealed locations, & constructed of yellow brass with a stainless steel insert.
5. All fittings shall be provided with a plastic containment coupling & a ¼" NPT vent port to provide venting as required.
6. The underground piping system shall be listed by the International Code Council (ICC) or the International Association of Plumbing & Mechanical Officials (IAPMO) for underground or underground beneath building applications
7. Vent pipe material shall be schedule 40 black steel. All vent piping shall be routed & terminated per the International Fuel Gas Code & NFPA 54 requirements.
8. Approved manufacturers: TracPipe PS-II or prior approved equal.

2.3 EXCEPTIONS

- A. All piping distributed within the building and above 5 psi is required to be welded.
- B. Gas piping is prohibited from being installed in solid partitions or walls unless a chase or casing (pipe sleeve) is provided.
- C. Threaded fittings shall not be used for pipe sizes 4 inches and larger.

2.4 VALVES

A. Acceptable Manufacturers:

1. A.Y. McDonald
2. Homestead
3. Nibco
4. Milwaukee
5. Nordstrom
6. Mueller.

B. All valves shall be designed, manufactured and approved for natural gas service.

C. Line Shut-off Valves sizes 2" and smaller:

1. Iron body lubricated plug valve conforming to ASME B16.33, U.L. Listed, and A.G.A. Approved for natural gas service with threaded ends, wrench operation, rated for 175 WOG service pressure and -20 to 150° F.
2. Brass body, full port ball valve conforming to ASME B16.44 and U.L. Listed. Blowout-proof stem and PTFE seats. Approved for natural gas service not to exceed 5 psig with threaded ends, rated for 600 WOG, 150 PSI WSP and 32 to 125°F working temperature.

D. Line Shut-off Valves sizes 2 1/2" and larger:

1. Iron body lubricated plug valve conforming to ASME B16.38, U.L. Listed, and A.G.A. Approved for natural gas service with flanged ends, wrench operation, rated for 125 WOG service pressure and -20 to 150° F.
2. Brass body, full port ball valve conforming to ASME B16.44 and U.L. Listed. Blowout-proof stem and PTFE seats. Approved for natural gas service not to exceed 5 psig with threaded ends, rated for 600 WOG, 150 PSI WSP and 32 to 125°F working temperature.

E. Appliance/Equipment Shut-off Valves at local connections sizes two (2) inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed, and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275° F.

F. Manual Emergency Shut-off Valves 2" and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed, and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275° F.

G. Automatic Emergency Shut-off Valves shall be U.L. Listed and F.M. Approved for natural gas service, two (2)-way electrically tripped solenoid type; fail safe closed; manual reset; Type 1 solenoid enclosure; NBR seals and disc; stainless steel core tube and springs; copper coil.

2.5 PRESSURE REGULATORS

- A. Acceptable Manufacturers:
 - 1. Fisher
 - 2. Maxitrol
 - 3. Rockwell
 - 4. Schlumberger.
- B. All pressure regulators shall be designed, manufactured and approved for natural gas service.
- C. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for equipment. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected unit. Regulator shall have a single port with orifice diameter no greater than that recommended by manufacturer for the maximum gas pressure at the regulator inlet. Regulator vent valve shall be of resilient materials designed to withstand flow conditions when pressed against valve port. Regulator shall be capable of limiting build-up of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Commercial grade diaphragm type with internal relief valve, vent valve, cast iron body, Buna-N diaphragm.
- D. Install pressure gauge adjacent to and downstream of each line pressure regulator.

2.6 UNIONS

- A. Unions in 2" and smaller in ferrous lines shall be Class 300 AAR malleable iron unions with iron to brass seats, 2-1/2" and larger shall be ground flange unions. Companion flanges on lines at various items of equipment, machines and pieces of apparatus may serve as unions to permit disconnection of piping.
- B. Unions connecting ferrous pipe to copper or brass pipe shall be Epco dielectric type.
- C. Above grade flexible stainless steel appliance/equipment connectors shall conform with AGA under the ANSI Z21.69 Standard. Hose shall be braided stainless steel with a polyolefin heat-shrink tubing with high flame-retardant qualities. Hose shall be equipped with malleable iron unions and spring loaded brass quick-link couplings. An easily accessible manual shut-off valve shall be installed ahead of all hose connections. Specify T&S Brass "Safe-T-Link" or approved equal.

2.7 FLANGES

- A. All 150 lb. and 300 lb. ANSI flanges shall be domestically manufactured, weld neck forged carbon steel, conforming to ANSI B16.5 and ASTM A-181 Grade I or II or A-105-71. Slip on flanges shall not be used.
- B. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Complete test reports may be required for any fitting selected at random.

- C. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forges will not be acceptable. Flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25.
- D. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. Threaded rods will not be an acceptable alternate for flange bolts. Bolts shall have a tensile strength of 60,000 psi and an elastic limit of 30,000 psi.
- E. Flat-faced flanges shall be required to match flanges on pumps, check valves, strainers, etc. Only one (1) manufacturer of weld flanges will be approved for each project.
- F. All flanges shall be gasketed. Contractor shall place gasket between flanges of flanged joints. Gaskets shall fit within the bolt circle on raised face flanges and shall be full face on flat face flanges. Gaskets shall be cut from 1/16" thick, non metallic, non asbestos gasket material suitable for operating temperatures from -150° F to +75° F.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. Accept piping, fittings, and accessories on Site in shipping containers with labeling in place, inspect for damage and store with a minimum of handling. Store plastic piping under cover out of direct sunlight. Do not store materials directly on the ground.
- B. Provide temporary protective coating on all cast iron and steel devices.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

3.2 PREPARATION

- A. Ream pipe ends and remove cutting burrs. Bevel plain end ferrous pipe.
- B. Remove cutting oil, scale and dirt, on inside and outside of piping, before assembly.

3.3 PAINTING

- A. Prepare all piping as needed to allow for proper coverage and adherence.
- B. Piping to be painted includes the following:
 - 1. Exterior to building: Color selected by Architect.
 - 2. Interior to building: Yellow
 - 3. Extension of existing system: Match existing color

3.4 EQUIPMENT CONNECTIONS

- A. Provide specified connections, shutoff valves, regulators and unions at each and every appliance and piece of equipment requiring natural gas, including equipment furnished under other Divisions of these Specifications and/or by the Owner.
- B. Provide and install union type connections at all equipment to permit removal of service piping.
- C. Gas service connections shall have a diameter at least one (1) pipe size larger than that of the inlet connection to the equipment as provided by the manufacturer and be of adequate size to provide the total input demand of the connected equipment.
- D. Provide listed and labeled appliance connectors complying with ANSI Z21.69 and listed for use with food service equipment having casters, or that is otherwise subject to movement for cleaning, and other large movable equipment. Connectors shall have listed and labeled quick-disconnect devices and shall have retaining cables attached to structures and equipment. Connectors shall not be concealed within or extended through wall, floor or partition and shall be located entirely in the same room as the connected equipment. Provide an accessible shut-off valve not less than the nominal size of the equipment connector, immediately ahead of the connector.
- E. Rigid metallic pipe and fittings shall be used at service connections to all permanently stationary equipment.

3.5 INSTALLATION - GENERAL

- A. All gas piping installed in return air plenums shall be welded.
- B. Valves shall not be installed in concealed locations and return air plenums.
- C. Line shutoff valves installed exterior to the building shall be lubricated plug valves. Line shutoff valves installed interior to the building shall be full-port ball valves.
- D. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- E. All installation shall be in accordance with manufacturer's published recommendations.
- F. Provide support for and connections to natural gas service meter in accordance with requirements of the utility company.
- G. All installation shall be in accordance with manufacturer's published recommendations.
- H. All above ground gas piping shall be electrically continuous and bonded to electrical system ground conductor in accordance with NFPA 70.
- I. Provide and install unions at proper points to permit dismantling or removal of pipe. No unions will be required in welded lines except at equipment connections.
- J. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric union, coupling or dielectric flange fitting.

- K. Valves, regulators, flanges, unions and similar appurtenances shall be accessible for operation and servicing and shall not be located above ceilings in accessible locations or within partitions.
- L. Route piping in orderly manner and maintain gradient. Install piping to conserve building space. Group piping whenever practical at common elevations.
- M. Install piping to allow for expansion and Contraction without stressing pipe, joints, or connected equipment.
- N. Make service connections at the top of the main, whenever the depth of the main is sufficient to allow top connections. When service connections cannot be made at the top of the main, they shall be made on the side of the main no lower than the horizontal midpoint of the gas main.
- O. Cross type fittings shall not be installed in any gas line. Bushings shall not be used in conjunction with any gas piping.
- P. Slope piping and arrange to drain at low points. Install drip/sediment traps at points where condensate and debris may collect. Locate drip/sediment traps where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing. Construct drip/sediment traps using tee fitting with capped nipple connected to bottom outlet. Use minimum-length nipple of three (3) pipe diameters, but not less than 4 inches long, and same size as connected pipe. Cap shall be screwed pattern, black, standard weight, malleable iron. Install with adequate space for removal of cap.
- Q. Install valves for shut off and to isolate equipment, parts of systems, or vertical risers. All valves shall be located such that servicing and operation is possible. All flanged valves shown in horizontal lines with the valve stem shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested and inspected for final acceptance. Valves shall be installed as nearly as possible to the locations indicated in the Contract Drawings. Any change in valve location must be so indicated on the Record Drawings.
- R. Install line shut-off valve at each branch connection to riser. Branch line shut-off valves shall be automatic type where indicated on Drawings.
- S. Provide adequate clearance for access to and operation of all valves.
- T. Install valves with stems upright or horizontal, not inverted unless required otherwise by the valve manufacturer.
- U. Pipe vents from gas pressure reducing valves and pipe casing sleeves to the exterior of the building and terminated with outlet turned down and capped with corrosion resistant insect screen. Vent terminations shall be at least seven feet above grade or pedestrian traffic and a minimum five (5) feet above or twenty five (25) feet horizontally from all air intakes or building openings.
- V. Above ground horizontal natural gas and encasement piping shall be supported at intervals of no greater than 6 foot for 1/2" piping, 8 foot for 3/4" and 1" piping and 10 foot for 1-1/4" and larger piping. Vertical piping shall be supported at each floor level and at intervals as specified for horizontal piping.

- W. Extension bars shall not be used for supporting gas or encasement piping. Gas or encasement piping shall not be used to support any other piping or component.

3.6 INSTALLATION - UNDERGROUND

- A. All excavation required for gas piping is the responsibility of the contractor and shall be done in accordance with project Specifications.
- B. Do not install underground piping when bedding is wet or frozen.
- C. Bury all underground piping at least three (3) feet below finished grade. Provide a continuous detectable warning tape on tamped backfill, 12" above all buried non-metallic gas lines. Refer to Mechanical Identification Section 230553 for underground warning tape requirements.
- D. Do not install gas piping in the same trench with other utilities. The minimum horizontal clearance between gas pipe and parallel utility pipe shall be two (2) feet. Do not install gas pipe through catch basins, vaults, manholes or similar underground structures.

3.7 INSTALLATION – POLYETHYLENE SERVICE PIPING

- A. Install and support all polyethylene piping in accordance with manufacturer's recommendations. All heat fusion welds shall be performed by welders qualified to the manufacturer's procedures.
- B. Polyethylene piping shall not be installed above ground.
- C. Provide connection between buried plastic gas piping and metallic riser in accordance with the gas code.

3.8 INSTALLATION - WELDED PIPING

- A. Welding of pipe in normally occupied buildings is prohibited. Off-Site welding is acceptable. Should welding be required in a normally occupied building for connecting to an existing welded system, obtain written approval from the Construction Manager and comply with Owner's fire and life safety requirements.
- B. Piping and fittings shall be welded and fabricated in accordance with ASME/ANSI.
- C. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Maintain inside of fittings free from globules of weld metal. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process. All pipes shall have the ends beveled 37 1/2 degrees and all joints shall be aligned true before welding. Except as specified otherwise, all changes in direction, intersection of lines, reduction in pipe size and the like shall be made with factory-fabricated welding fittings. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.
- D. Align piping and equipment so that no part is offset more than 1/16". Set all fittings and joints square and true and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

- E. Contractor shall not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welded during welding operation.
- F. In no cases shall Schedule 40 pipe be welded with less than three (3) passes including one (1) stringer/root, one (1) filler and one (1) lacer. Schedule 80 pipe shall be welded with not less than four (4) passes including one (1) stringer/root, two (2) filler and one (1) lacer. In all cases, however, the weld must be filled before the cap weld is added.

3.9 INSTALLATION – CORRUGATED STAINLESS STEEL TUBING

- A. Install and support all corrugated stainless steel tubing in accordance with manufacturer's recommendations.
- B. All piping system vents shall be routed to the building exterior per code & local AHJ requirements.

3.10 WELD TESTING

- A. All welds are subject to inspection, visual and/or x-ray, for compliance with Specifications. At the Owner's option, the Owner will provide employees or employ a testing laboratory for the purposes of performing said inspections and/or x-ray testing. Initial visual and x-ray inspections will be provided by the Owner. The Contractor shall be responsible for all labor, material and travel expenses involved in the re-inspection and retesting of any welds found to be unacceptable. In addition, the Contractor shall be responsible for the costs involved in any and all additional testing required or recommended by ASME/ANSI Standards B31.1 and B31.3 due to the discovery of poor, unacceptable or rejected welds.
- B. Welds lacking penetration, containing excessive porosity or cracks, or are found to be unacceptable for any reason, must be removed and replaced with an original quality weld as specified herein. All qualifying tests, welding and stress relieving procedures shall, moreover, be in accord with Standard Qualification for Welding Procedures, Welders and Welding Operators, Appendix A, Section 6 of the Code, current edition.

3.11 TESTING

- A. All natural gas systems shall be inspected, tested, purged and placed into operation in accordance with NFPA 54 and as required herein.
- B. All natural gas piping systems shall be very carefully inspected, tested, purged and placed into operation by a Licensed Plumber.
- C. All necessary apparatus for conducting tests shall be furnished by the Contractor and comply with the requirements of NFPA 54.
- D. All new rough-in distribution piping and affected portions of existing systems connected to, shall be subjected to a pneumatic test pressure utilizing clean, dry air and must be demonstrated to be absolutely tight when subjected to the pressures and time durations listed herein. All equipment and components designed for operating pressures of less than the test pressure shall not be connected to the piping system during test.
- E. Systems on which the normal operating pressure is less than 0.5 pounds per square inch gauge (psig), the test pressure shall be 5.0 psig and the time interval shall be thirty (30) minutes.

- F. Systems on which the normal operating pressure is between 0.5 psig and 5.0 psig, the test pressure shall be 1.5 times the normal operating pressure or 5.0 psig, whichever is greater, and the time interval shall be thirty (30) minutes.
- G. Systems on which the normal operating pressure is 5.0 psig or greater, the test pressure shall be 1.5 times the normal operating pressure, and the time interval shall be one (1) hour.
- H. After testing is complete, the entire gas system shall be purged with dry nitrogen to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system.
- I. After successful results of pressure test and purging have been completed, a leakage test shall be performed in accordance with NFPA 54 Appendix D.
- J. Connect, inspect and purge gas utilization equipment, lab hook-ups, outlets, etc., and place into operation only after successful results of pressure test, leakage test and purging have been completed and accepted.
- K. In all instances in which leaks are then found, they shall be eliminated. Testing operations shall be repeated until gas-piping systems are absolutely tight at the pneumatic test pressures indicated above.
- L. Pressure test gas piping sleeve system with clean, dry compressed air at 15 psig by temporarily sealing all openings between gas carrier pipe and sleeve and vent openings. Sleeve systems must be demonstrated to be absolutely tight when subjected to this pressure for a period of four (4) hours.

END OF SECTION

**SECTION 23 31 13
METAL DUCTWORK**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all work required to provide and install the Ductwork Insulation indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA)
- B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
- C. Definition
 - 1. Low Pressure
 - a. 2 inch W.G. Pressure Class: Ductwork systems up to 2 inch w.g. positive or negative static pressure with velocities less than or equal to 1500 fpm.
 - 2. Medium Pressure
 - a. 3 inch W.G. Pressure Class: Ductwork systems over 2 inch w.g. and up to 3 inch W.G. positive or negative static pressure with velocities less than or equal to 2500 fpm.
 - b. 4 inch W.G. Pressure Class: Ductwork systems over 3 inch w.g. and up to 4 inch w.g. positive or negative static pressure with velocities less than or equal to 2500 fpm.
 - c. 6 inch W.G. Pressure Class: Ductwork systems over 4 inch w.g. and up to 6 inch w.g. positive or negative static pressure with velocities less than or equal to 2500 fpm.
 - 3. High Pressure
 - a. 10 inch W.G. Pressure Class: Ductwork systems over 6 inch w.g. and up to 10 inch w.g. positive or negative static pressure with velocities greater than 2500 fpm.

1.3 SUBMITTALS

- A. Shop Drawings
 - 1. Submit CAD drawn duct layout drawings for all project ductwork. Submit detailed elevations and sections where required to convey complete scope of work. Shop drawings shall be based on other trades contract drawings and field dimensions. Submit drawings on full size paper at 1/4" = 1'-0" scale.
 - 2. Layouts for areas in which it may be necessary to deviate substantially from layout shown on the Drawings. Show major relocation of ductwork and major changes in size of ducts. Minor transitions in ductwork, if required due to job conditions, need not be submitted as long as the duct area is maintained.

3. Layout and fabrication details for cooking equipment exhaust ductwork.
 4. Layouts of mechanical equipment rooms and penthouses.
 5. Details of intermediate structural steel members required to span main structural steel for the support of ductwork.
 6. Method of attachment of duct hangers to building construction.
- B. Coordinate shop drawings with related contractors prior to submission.
- C. Product Data: Material, gauge, type of joints, sealing materials, and reinforcing for each duct size range, including sketches or SMACNA plate numbers for joints, method of fabrication and reinforcing. Include ACGIH figure numbers for hoods if applicable.

1.4 QUALITY ASSURANCE

- A. SMACNA: Gauges of materials, fabrication, reinforcement, sealing requirements, installation, and method of supporting ductwork shall be in accordance with the following SMACNA manuals, unless otherwise shown or specified:
1. HVAC Duct Construction Standards
 2. Round Industrial Duct Construction Standard
 3. Rectangular Industrial Duct Construction Standard
- B. Unless otherwise shown or specified, follow the Hood Design Data, and Construction Guidelines for Local Exhaust Systems from the ACGIH Industrial Ventilation Manual.
- C. Conform to the applicable requirements of NFPA 90A, 90B, 91, 96, and 101.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Metal
1. Aluminum: ASTM B-209, Alloy 3003, Temper H-14.
 2. Carbon Steel: 16 gauge black iron
 3. Galvanized Steel: ASTM A653, ASTM A924, Class LFQ (lock forming quality), coating designation G-60.
 4. Galvannealed Steel: ASTM A653, ASTM A924, Class LFQ (lock forming quality), coating designation A-40.
 5. Stainless Steel: AISI Types 302, 304 and 316, as specified.

B. Duct Hangers

1. Strap Hangers: Same material as ducts, except that hangers for stainless steel ducts in unfinished spaces may be galvanized steel.
2. Rod Type Hangers: Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with 2 removable nuts each end for positioning and locking rod in place. Unless stainless steel, galvanized or cadmium plated; shop coat with metal primer.

C. Miscellaneous Fasteners and Upper Hanger Attachments

1. Sheet Metal Screws, Machine Bolts and Nuts: Same material as duct, unless otherwise specified.
2. Concrete Inserts: Steel or malleable iron, galvanized; continuously slotted or individual inserts conforming with MSS SP-58, Types 18 & 19, Class A-B.
3. C Clamps: Fee & Mason Co.'s 255L with locking nut, and 255S with retaining strap.
4. Metal Deck Ceiling Bolts: B-Line Systems, Inc.'s Fig. B3019.
5. Welding Studs: Erico Fastening Systems, capacitor discharge, low carbon steel, copper flashed.
6. Structural (carbon) Steel Shapes and Steel Plates: ASTM A36, shop primed.
7. Stainless Steel Shapes and Plates: ASTM A276 and ASTM A666.
8. Machine Bolt Expansion Anchors
 - a. Non-caulking single unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 1.
 - b. Non-caulking double unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 2.
 - c. Self-drilling type: FS FF-S-325, Group III, Types 1 and 2.

2.2 FABRICATION – GENERAL

- A. Refer to the ductwork application schedule on the drawings for the types and material usage for the various ductwork types required.
- B. Duct sizes shown on the Drawings are inside clear dimensions available for air movement. Verify with duct construction method to determine exterior dimensions for layout and fabrication purposes.
- C. Fabricate ductwork from galvanized sheet metal, except as follows:
 1. Fabricate the following ductwork from aluminum:
 - a. Inlet and discharge ductwork connected to cooling towers and evaporative condensers.
 - b. Exhaust ductwork from shower, locker, car washing and steam service rooms, and swimming pool areas.
 - c. Dryer exhaust ductwork. Aluminum ductwork for dryer exhaust shall be a minimum of 26 gauge.

2. Fabricate the following ductwork from galvanized steel:
 - a. Ductwork in exposed areas that will be painted.
3. Fabricate the following ductwork from stainless steel:
 - a. Exhaust ductwork connected to cooking equipment, dishwashing, and other scullery equipment hoods. Install stainless steel from the individual hood to its respective fan and from the fan to the point of discharge to the outside air. Use AISI Type 302 or 304 stainless steel.
- D. Dissimilar Metals: Separate dissimilar metals used for ductwork with 12 oz vinyl coated woven fiberglass duct connector fabric, such as Duro Dyne's Glassteel. No separation is required between screws or rivets and the materials in which they are inserted.

2.3 FABRICATION OF STAINLESS STEEL DUCTS

- A. Use minimum No. 18 gauge for exhaust ducts connected to cooking equipment hoods. Use minimum No. 20 gauge for exhaust ducts connected to other hoods. Use minimum 26 gauge for dryer exhaust ducts.
- B. Use stainless steel reinforcing members for ducts in finished spaces and galvanized steel in unfinished spaces.
- C. Longitudinal Seams for Dishwashing, and Other Scullery Equipment Exhaust Ducts: Form double corner seams, or Pittsburgh lock seams.
 1. Fabricate elbows and transitions with Pittsburgh lock seams.
 2. Fabricate double compounded elbows and other complex fittings with double corner seams.
 3. Locate seams in horizontal ducts at top corners of ducts, unless otherwise approved in writing.
 4. Locate seams in vertical ducts at rear corners of ducts.
- D. All exposed stainless steel ductwork shall have a #3 finish.

2.4 REGISTERS AND GRILLES INSTALLED IN EXPOSED DUCTWORK

- A. Frames are not required for registers and grilles installed directly in un-insulated exposed ductwork.
- B. Cut openings in ducts, forming a double thickness of metal, to attach registers or grilles with sheet metal screws. Bend back edges of openings into duct, on all four (4) sides, a minimum of 1 inch to provide the thickness of metal stated above. Provide felt or sponge rubber gasketing, all four (4) sides of duct openings, for supply grilles and supply registers.

2.5 AIR DIFFUSERS INSTALLED IN EXPOSED DUCTWORK

- A. Frames are not required for diffusers installed directly in un-insulated exposed ductwork.

- B. Cut and form openings in ducts, to accommodate the specified volume control damper and adjustable equalizing grid assembly. Reinforce openings as required and approved. Provide felt or sponge rubber gasketing, around duct opening, for supply diffuser assemblies.

2.6 VIBRATION ISOLATION FOR DUCTWORK

- A. Type: Combination rubber and spring type designed for insertion in a split hanger rod for isolating ductwork from the overhead construction.
 - 1. Approved isolators: Amber Booth Type BSSR, Korfund Type VX, Mason Industries, Type DNHS, Vibration Eliminator Co. Type SNRC and Vibration Mountings and Controls Type RSH.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install ductwork to allow maximum headroom. Properly seam, brace, stiffen, support, and render ducts mechanically airtight. Adjust ducts to suit job conditions. Dimensions may be changed as approved if cross sectional area is maintained.
- B. Provide necessary transformation pieces, and flexible fabric connections for ductwork connected to air handling equipment or air inlet and outlet devices. Flexible fabric connections installed at equipment exterior to the building shall be rated for UV exposure and suitable for exterior use per ASTM G155 testing requirements. Metal for these connections shall be aluminum or stainless steel, galvanized connections shall not be allowed.

3.2 SEALING SEAMS, JOINTS, AND PENETRATIONS

- A. Seal ductwork in accordance with the SMACNA Manual except for the following:
 - 1. Ductwork Specified to be Insulated: Conform with Seal Class A for all pressure classes.
 - 2. Cooking Equipment Exhaust Ductwork: Conform with NFPA 96.
 - 3. Horizontal Ductwork for Dishwashing, and Other Scullery Equipment Exhausts
 - a. Continuously solder transverse joints vaportite along bottom, and up both sides two (2) inches minimum.
 - b. Continuously solder longitudinal seams vaportite if seams are approved to be located at bottom of duct.
 - 4. Exhaust ductwork joints shall not use sheetmetal screws or other fasteners that protrude into the ductwork to catch lint and debris. Ducts shall insert and adjoin to the next duct or fitting in the direction of airflow. Seal all joints and seams vapor tight with ductwork foil tape.
 - a. Commercial dryers or dryer exhaust systems serving multiple appliances shall utilize flanged and gasketed connections.

3.3 HANGERS FOR DUCTS, UNDER 2 INCHES W.G.

- A. Install hangers for ducts as specified in the SMACNA Manual, with the following exceptions:
1. Rectangular ducts up to 42 inches wide, not having welded or soldered seams, and supported from overhead construction; extend strap hangers down over each side of the duct and turn under bottom of duct a minimum of two (2) inches. Secure hanger to duct with three (3) full thread sheet metal screws, one (1) in the bottom and two (2) in the side of the duct.
 2. Rectangular ducts 43 inches wide and over, and all sizes of duct with welded or soldered seams, and supported from overhead construction; use trapeze hangers.
 3. Prime coat plain steel rods threaded at the site immediately after installation with metal primer.
 4. Dryer exhaust ductwork shall be supported at 48 inch intervals.

3.4 HANGERS FOR DUCTS, 2 INCHES W.G. AND OVER

- A. Install hangers for ducts as specified in the SMACNA Manual, with the following exceptions:
1. Support rectangular ducts with welded seams, regardless of size, by means of trapeze hangers, framed all four (4) sides. Provide minimum 1 x 1 x 1/8 inch angle iron framing for duct having a maximum side dimension up to and including 36 inches in size. Install framing snug to all four (4) sides of duct.

3.5 UPPER HANGER ATTACHMENTS

- A. General
1. Secure upper hanger attachments to structural steel or steel bar joists wherever possible.
 2. Do not use drive-on beam clamps, flat bars or bent rods, as upper hanger attachments.
 3. Do not attach hangers to steel decks which are not to receive concrete fill.
 4. Do not attach hangers to precast concrete planks less than 2-3/4 inches thick.
 5. Avoid damage to reinforcing members in concrete construction.
 6. Metallic fasteners installed with electrically operated or powder driven tools may be used as upper hanger attachments, in accordance with the SMACNA Manual, with the following exceptions:
 - a. Do not use powder driven drive pins or expansion nails.
 - b. Do not attach powder driven or welded studs to structural steel less than 3/16 inch thick.
 - c. Do not support a load, in excess of 250 lbs from any single welded or powder driven stud.
 - d. Do not use powder driven fasteners in precast concrete.

- B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by ductwork support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of five (5).
1. Secure upper hanger attachments to steel bar joists at panel points of joists.
 2. Do not drill holes in main structural steel members.
- C. Attachment to Concrete Filled Steel Decks
1. New Construction: Install metal deck ceiling bolts.
 2. Existing Construction: Install welding studs (except at roof decks).
 3. Do not attach hangers to decks less than 2-1/2 inches thick.
- D. Attachment to Existing Cast-In Place Concrete
1. Secure hangers to overhead construction with self drilling type expansion anchors and machine bolts.
 2. Secure hanger attachments required to be supported from wall or floor construction with single unit expansion anchors or self drilling type expansion anchors and machine bolts.
- E. Attachment to Cored Precast Concrete Decks (Flexicore, Dox Plank, Spancrete, etc.): Toggle bolts may be installed in cells for the support of ducts up to a maximum of 60 inches in width.
- F. Attachment to Hollow Block or Hollow Tile Filled Concrete Decks
1. New Construction: Omit block or tile and pour solid concrete with cast-in-place inserts.
 2. Existing Construction: Break out block or tile to access and install machine bolt anchors at highest practical point on side of web.
- G. Attachment to Waffle Type Concrete Decks
1. New Construction: Install cast-in-place inserts.
 2. Existing Construction: Install machine bolt expansion anchors at highest practical point on side of web.
- H. Attachments to Precast Concrete Tee Construction
1. Secure hangers to tees by any of the following methods:
 - a. Tee hanger inserts between adjacent flanges.
 - b. Install double unit expansion anchors and machine bolts at highest practical point on side of web.
- I. Attachment to Wood Construction
1. Secure strap hangers to the sides of wood beams with one (1) No. 18 x 1-1/2 inch long (minimum) wood screws or two (2) No. 16 x 1-1/2 inch long (minimum) drive screws. Do not hammer in wood screws.

2. Secure rod hangers to angle iron clip angles, bolted or screwed to the sides of the wood beams with 3/8 inch bolts or 3/8 inch lag screws. Install hanger rods with a threaded end through a hole in the angle, secured with a double nut, one (1) above and one (1) below the angle. Do not use lag screws in wood beams, having a nominal face width under 2 inches. Install bolts or lag screws in the side of beams at mid-point or above.
3. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.
4. Where wood trusses are approved to support ductwork, hangers may be attached only to the bottom chord. Method of attachment must be specifically approved.
5. Do not secure hanger attachments to nailing strips resting on top of steel beams.

3.6 DUCT RISER SUPPORTS, UNDER 2 INCHES W.G.

- A. Support vertical round ducts by means of double-ended split steel pipe riser clamps bearing on floor slabs or adjacent structural members, at every other floor through which the riser passes.
- B. Unless otherwise specified or shown on the drawings, support vertical rectangular ducts by means of two steel angles, secured to duct and resting on floor slab or adjacent structural steel member, at every other floor through which the duct passes. Size supports as follows:

MAX. SIDE DIMENSION (inches)	SUPPORT ANGLE (inches)	SECURE TO DUCT WITH	MIN BEARING AT EACH END (inches)
36	1 x 1 x 1/8	Screws	2
48	1-1/2 x 1-1/2 x 1/8	Bolts	3
60	2 x 2 x 1/8	Bolts	3
61 - up	2-1/2 x 2-1/2 x 3/16	Bolts	4

3.7 DUCT RISER SUPPORTS, 2 INCHES W.G. AND OVER

- A. Support vertical round ducts by means of double-ended split steel pipe riser clamps welded to the ducts and bearing on floor slabs or adjacent structural members, at every other floor through which the riser passes.
- B. Support vertical rectangular ducts by means of two steel angles or channels, anchor bolted to floor slab or adjacent structural member at every other floor through which the riser passes. Secure steel angles or channels to a transverse joint by means of 3/8 inch bolts, or by welding. Size supports as follows:

MAXIMUM SIDE DIMENSION (inches)	SUPPORT ANGLE (inches)	SUPPORT CHANNEL (inches)	MINIMUM BEARING AT EACH END (inches)
36	1 x 1 x 1/8	1 x 1/2 x 1/8	2
48	1-1/2 x 1-1/2 x 1/8	1-1/2 x 3/4 x 1/8	3
60	2 x 2 x 1/8	2 x 1 x 1/8	3
61 - up	2-1/2 x 2-1/2 x 3/16	2 x 1 x 3/16	4

3.8 VIBRATION ISOLATION FOR DUCTWORK

- A. Install vibration isolation in accordance with the manufacturer's printed installation instructions, unless otherwise specified.
- B. Install in locations shown or scheduled on the Drawings.
- C. High Velocity Ductwork Installed within Mechanical Equipment, Machine and Penthouse Mechanical Equipment Rooms: Provide combination rubber and spring type isolators, designed for insertion in a split hanger rod for overhead supported ductwork and double rubber-in-shear isolators for floor supported ductwork. Provide isolators designed for a static deflection of 1/2 inch.

3.9 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state, and local requirements, referenced standards, and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Cleanliness
 - 1. Before installing ductwork, wipe ductwork to a visibly clean condition.
 - 2. During construction, provide temporary closures of metal or taped polyethylene on open ductwork and duct taps to prevent construction dust or contaminants from entering ductwork system. Seal ends of ductwork prior to installation to keep ductwork interior clean. Remove closures only for installation of the next duct section.
 - 3. During duration of construction, maintain the integrity of all temporary closures until air systems are activated.
 - 4. Provide openings in ductwork where required to accommodate thermometers, controllers, and other devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring. Sleeve of pitot tube opening shall be no more than one inch long. Opening shall be one inch wide to accept pitot tube.
 - 5. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
 - 6. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
 - 7. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout. Use polished stainless steel for ductwork exposed to view and mill stainless steel for ducts where concealed.
 - 8. All visible welds in ductwork between biosafety cabinets, canopy hoods and fume hoods and the ceiling shall be ground and polished.

9. Slope duct toward grilles for moisture-laden ducts. Provide drain and trap at elbow of main moisture exhaust duct system.

D. Exposed Ductwork

1. Remove all markings, stickers, and labels.
2. Completely clean the exterior of all ducts prior to painting, duct is to be painted prior to project completion.
3. All exposed ductwork shall have a 'paintgrip' finish to allow for normal paint application without additional field labor by the painter. See architectural drawings for areas with exposed ceiling to be painted.
4. Any ductwork deemed in unsightly by the Architect/Engineer/Owner will be replaced at the Contractor's expense.

E. Hangers and Supports

1. All ductwork supports shall be in accordance with Table 4-1 (rectangular duct) and Table 4-2 (round duct) of the SMACNA Standards, with all supports directly anchored to the building structure.
2. Rectangular duct shall have at least one pair of supports on minimum 8'-0" (eight feet) centers. All horizontal round and flat oval ducts shall have ducts hangers spaced 10'-0" (ten feet) maximum.
3. Lower attachment of hanger to duct shall be in accordance with Table 4-4 of the SMACNA Standards.
4. Vertical ducts shall be supported where they pass through the floor lines with 1-1/2 inch x 1-1/2 inch x 1/4 inch angles for duct widths up to 60 inches. Above 60 inches in width, the angles must be increased in strength and sized on an individual basis considering space requirements.
5. Hanger straps on duct widths 60 inches and under shall lap under the duct a minimum of 1 inch and have minimum of one fastening screw on the bottom and two on the sides.
6. Hanger straps on duct widths over 60 inches shall be bolted to duct reinforcing with 3/8 inch bolts minimum.

3.10 DUCTWORK SYSTEM CLEANING

- A. If the system has been operated without schedule filters or if the integrity of temporary closures has been compromised, Contractor shall have ductwork cleaned according to National Air Duct Cleaners Association (NADCA) Standards by a Certified Regular Member of the NADCA.
- B. For ductwork supplying Clean Rooms or patient care areas, also sanitize the ductwork interior per NADCA standards with a biocidal agent approved by the EPA for use in HVAC systems.

- C. Before turning the installation over to the Owner, Contractor shall certify that the air handling systems have only been operated with scheduled filters in place. Otherwise, Contractor shall present evidence that the ductwork cleaned as required above.

3.11 TESTING

- A. A minimum of 25% of all medium and high pressure duct systems (positive or negative) shall be pressure tested according to SMACNA test procedures (HVAC Air Duct Leakage Test Manual) and ASHRAE Standard 90.1 requirements. The ductwork to be tested shall be 25% of the lineal feet of ductwork mains starting at the air handling unit or fan.
 - 1. Notify Owner minimum seven (7) calendar days in advance of leakage testing.
 - 2. Design pressure for testing ductwork shall be determined from the maximum pressure generated by the fan at the nominal motor horsepower selected.
 - 3. Total allowable leakage shall not exceed 1 percent of the total system design airflow rate.
 - 4. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
 - 5. Leaks identified during leakage testing shall be repaired by:
 - a. Complete removal of the sealing materials.
 - b. Thorough cleaning of the joint surfaces.
 - c. Installation of multiple layers of sealing materials.
 - 6. The ductwork system to be tested, shall exclude connections downstream of the terminal units (i.e., ductwork shall be capped immediately prior to the terminal units, and tested as described above).
 - 7. After testing has proven that ductwork is installed and performs as specified, the terminal units shall be connected to ductwork and connections sealed with extra care. Contractor shall inform the Owner when joints may be visually inspected for voids, splits, or improper sealing of the joints. If any leakage exists in the terminal unit connections/joints after the systems have been put into service, leaks shall be repaired as specified for other leaks.
- B. All low-pressure duct systems (positive or negative) shall be inspected for visible and audible signs of leakage.
- C. Leaks identified by inspection shall be repaired by
 - 1. Complete removal of the sealing materials.
 - 2. Thorough cleaning of the joint surfaces.
 - 3. Installation of multiple layers of sealing materials.
- D. Discrepancies found during testing and balancing between duct traverses and diffuser/grille readings shall result in re-inspection, repair and retest until discrepancies are eliminated.
- E. Ductwork leakage testing and/or inspection shall be performed prior to installation of external ductwork insulation.

END OF SECTION

**SECTION 23 33 00
DUCTWORK ACCESSORIES**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the ductwork accessories indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section
 - 1. Airflow Control Dampers and Spin-In Fittings
 - 2. Flexible Duct
 - 3. Flexible Duct Elbow Supports
 - 4. Flexible Duct Connections
 - 5. Duct Access Doors
 - 6. Screens

1.2 REFERENCES

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. AMCA 500D – Laboratory Method of Testing Dampers for Rating
 - 2. AMCA 500L – Laboratory Method of Testing Louvers for Rating
 - 3. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 - 4. NFPA 101 - Life Safety Code
 - 5. SMACNA - HVAC Duct Construction Standards
 - 6. UL 33 - Heat Responsive Links for Fire-Protection Service
 - 7. UL 555 – Standard for Fire Dampers
 - 8. UL 555C – Standard for Ceiling Radiation Dampers

9. UL 555S – Standard for Smoke Dampers

1.3 SUBMITTALS

A. Product Data

1. Provide product data for shop fabricated assemblies including, but not limited to, volume control dampers, duct access doors, and duct test holes. Provide product data for hardware used.

B. Record Documents

1. Fire Dampers: The damper manufacturer's literature submitted for approval prior to the installation shall include performance data developed from testing in accordance with AMCA 500D standards and shall show the pressure drops for all sizes of dampers required at anticipated air flow rates. Maximum pressure drop through fire damper shall not exceed 0.05-inch water gauge.
2. Combination Fire/Smoke Dampers: Assign identification numbers for each damper with corresponding number noted on Drawings. Provide air quantity, size, free area of damper, pressure drop and proposed velocity through each damper. Provide manufacturer's data of damper and its accessories or options. At Owner's request, provide two (2) dampers (18 inch x 12 inch) for the purpose of illustrating damper operation to Owner's operating and maintenance personnel.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 AIR FLOW CONTROL DAMPERS

A. Acceptable Manufacturers

1. Greenheck
2. Nailor Industries
3. Pottorff
4. Ruskin
5. Tamco
6. United Enertech
7. Louvers & Dampers, Inc.

9. Air Balance

- B. Furnish and install dampers where shown on the Drawings and wherever necessary for complete control of airflow, including all supply, return, outside air, and exhaust branches, "division" in main supply, return and exhaust ducts, and each individual air supply outlet. Where access to dampers through a permanent suspended ceiling (gypsum board) is necessary, the Contractor shall be responsible for the proper location of the access doors.
- C. Dampers larger than three (3) square feet in area shall be controlled by a self-locking splitter damper assembly.
- D. Volume damper blades shall not exceed 48 inches in length or twelve inches in width and shall be of the opposed interlocking type. The blades shall be of not less than No. 16 gauge galvanized steel supported on one-half inch diameter rust-proofed axles. Axle bearings shall be the self-lubricating ferrule type.
- E. Volume dampers and other manual dampers shall be carefully fitted, and shall be manually controlled by damper regulators as follows:
 - 1. On exposed non-insulated ductwork the locking quadrant shall be made with a base plate of 16-gauge cold-rolled steel and a heavy die cast handle designed with a 3/8 inch bearing surface. A 1/4 inch-20 zinc plated wing nut shall firmly lock the handle in place.
 - 2. On exposed externally insulated ductwork the regulator shall be 4-1/4 inch diameter, for 1/2 inch rod, designed for use on duct with insulation thickness specified for duct, and shall have four (4) 3/16 inch holes provided to rivet or screw regulator to the duct surface. The flange that covers the raw edge of the insulation shall be high enough so that it slightly compresses the insulation and holds insulation in place. The handle shall be 3/8 inch above the flange, and shall easily turn without roughing up the insulation.
 - 3. On concealed ductwork above inaccessible ceilings, the regulator shall be 2-5/8 inch diameter chromium plated cover plate that telescopes into the base, for 1/2 inch rod. Regulator shall be cast into a box for mounting in ceilings. Base shall be 1-1/2 inch deep. The cover shall be secured by two (2) screws that can be easily removed for damper adjustment.
 - 4. Furnish and install end bearings for the damper rods on the end opposite the quadrant.
- F. Spin-in fittings may be used for duct taps to air devices and shall include dampers on all ducts to air devices (diffusers and grilles) even though a volume damper is specified for the air device. Spin-in fittings shall be similar to Flexmaster FLD with BO3 including a 2 inch build-out, nylon bushings, locking quadrant similar to Duro Dyne KR-3, and a 3/8 inch square rod connected to the damper with U-bolts. Spin-in fittings shall be sealed at the duct tap with sealant as specified herein. Determine location of spin-in fittings after terminal units are hung or after location of light fixtures are confirmed to minimize flexible duct lengths and sharp bends.

2.3 FLEXIBLE DUCTS

- A. Acceptable Manufacturers
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
4. Thermaflex

B. Insulated, Flexible Duct:

1. Certifications:
 - a. UL 181,
 - b. ETL Class 1
 - c. NFPA 90A and 90B
 - d. Greenguard
2. Construction:
 - a. Single ply inner liner constructed of chlorinated polyethylene
 - b. Corrosion resistant galvanized steel core
 - c. Fibrous glass insulation with a minimum value of R-6.
 - d. Polyethylene vapor barrier film
3. Pressure Rating: 6-inch wg positive and 2-inch wg negative
4. Maximum Air Velocity: 5000 fpm
5. Temperature Range: -10° F to 160° F
6. Flame spread rating less than 25
7. Smoke developed rating of less than 50

2.4 FLEXIBLE DUCT ELBOW SUPPORTS

1. Acceptable Manufacturers
 - a. Build Right Products - FlexRight
 - b. Thermaflex – FlexFlow Elbow
 - c. RPS - FlowRite
2. Construction
 - a. Universal-mount, 1-piece, fully adjustable, radius-forming brace to support 4-inch through 16-inch diameter flexible air ducts.
 - b. Classified: UL 2043.
 - c. Material: 100 percent recycled copolymer polypropylene.
 - d. Support Frame Radius: 8 inches.
 - e. Compliance for Flexible Duct Radius:
 - 1) SMACNA HVAC Duct Construction Standards.
 - 2) ASHRAE Advanced Energy Design Guides.
 - 3) ADC Flexible Duct Performance and Installation Standards.

2.5 FLEXIBLE CONNECTIONS

- A. Where ducts connect to equipment, flexible connections shall be made using “Flexmaster TL-M” or “Ventglas” fabric that is temperature-resistant, fire-resistant, waterproof, mildew-resistant and

- B. Material used outdoors shall be resistant to ultra-violet sunrays. There shall be a minimum of 1/2" slack in the connections, and a minimum of 2 1/2" inches distance between the edges of the ducts. This does not apply to air handling units with internal isolation. A more rugged flexible material that is resistant to ultra-violet rays needs to be used when connecting an exhaust fan or exhaust air plenum to ductwork.

2.6 DUCT ACCESS DOORS

- A. Acceptable Manufacturers
 - 1. Greenheck
 - 2. Kees
 - 3. Nailor Industries
 - 4. Pottorff
 - 5. Ruskin
- B. Furnish and install in the ductwork, hinged rectangular, or round "spin-in" access doors to provide access to the following items:
 - 1. Major changes of direction in horizontal ducts connected to cooking equipment hoods and vertical grease duct risers as required by code for system cleaning. Refer to NFPA 96 and Specification Section 233113 for additional requirements.
 - 2. Motor operated dampers.
 - 3. Manually operated volume control devices.
 - 4. Fire, fire/smoke, and smoke dampers.
 - 5. Mixed air plenums
 - 6. In-line damper actuators installed in air stream.
 - 7. Heating coils (install upstream)
 - 8. Duct mounted humidifiers (upstream and downstream)
 - 9. Airflow stations
 - 10. Air filters replacement doors
 - 11. All locations where operating parts of any kind are installed in the ductwork and elsewhere as indicated on the plans.
- C. Access doors are not required, where a manually operated damper has an exposed damper regulator, with an indicating quadrant.
- D. Where ductwork is insulated, access doors shall be double skin doors with 1" of insulation in the door

E. Door Size

1. Door opening shall be adequately sized and positioned to allow for maintenance / replacement of any components located inside the ductwork. Based on the maximum duct dimension the following access door size minimum requirements are as follows:
 - a. 8" max duct dimension - One (1)-Hand or Inspection Access: 8" x 6" access door
 - b. 12" max duct dimension - Two (2)-Hand Access: 12" x 10" or 10" diameter access door
 - c. 18" max duct dimension - Head and Hand Access: 16" x 12" or 16" diameter access door
 - d. 26" max duct dimension - Head and Shoulders Access: 24" x 16" or 22" diameter access door
 - e. 30" max duct dimension - Body Access: 26" x 14" or 24" diameter access door
 - f. All other sizes - Body plus Ladder Access: 26" x 18" or 26" diameter access door
2. For duct access doors smaller than 16" x 12" Ventlok No. 90 sash style latches shall be used. For duct access doors 16" x 12" or larger Ventlok No. 260 latches shall be used.
3. A minimum of two latches are required for all access doors are required. Provide additional latches as needed to ensure the access door is sealing properly and there is not noticeable air leakage or air noise associated with the access door.

F. All access doors shall have a continuous gasket.

G. Round access doors shall be "Inspector Series" spin-in type door as manufactured by Flexmaster USA.

H. Where access doors are installed above a gyp board ceiling, this Contractor shall be responsible for providing and installing a ceiling access door of adequate size to utilize the access door and position it in the proper location.

2.7 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by this Contractor which lead to, or are located outdoors.
- B. Screens shall be No. 16 gauge, 1/2" mesh in removable frame as noted on drawings. Mesh and frame to be galvanized steel or aluminum as noted on the drawings.
- C. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Volume Dampers
 - 1. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 2. Install steel volume dampers in steel ducts.
 - 3. Install aluminum volume dampers in aluminum ducts.
 - 4. Set dampers to fully open position before testing, adjusting, and balancing.
 - 5. Position damper adjacent to the branch connection to the main when possible. Locate as far as from the opening it serves in all other instances.
- D. Test Holes
 - 1. Install test holes at fan inlets and outlets and elsewhere as indicated.
 - 2. Install duct test holes where required for testing and balancing purposes.
 - 3. Install test holes in locations as required to measure pressure drops across each item in the system, e.g., outside air louvers, filters, fans, coils, intermediate points in duct runs, etc.
- E. Fire, Fire / Smoke, Smoke Dampers
 - 1. Install fire, fire / smoke and smoke dampers according to UL listing.
 - 2. Provide fire dampers, and combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
 - 3. Fire and combination fire and smoke damper access panels shall be labeled with the words "Fire Damper" in letters not less than 1 inch (25 mm) in height.
 - 4. Install each fire and combination fire and smoke damper square and true to the building. The installation shall not place pressure on the damper frame, but shall enclose the damper as required by UL555 and UL555S.
- F. Duct Access Doors
 - 1. Install duct access doors on sides or bottoms of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - a. On both sides of duct coils.
 - b. Upstream and downstream from duct filters.
 - c. At outdoor-air intakes and mixed-air plenums.

- d. At drain pans and seals.
 - e. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - f. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links may be pressure relief access doors. If pressure relief access doors are used, they shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - g. At each change in direction and at maximum 50-foot spacing.
 - h. Upstream or downstream from duct silencers.
 - i. Control devices requiring inspection.
 - j. Elsewhere as indicated.
- 2. Install access doors with swing against duct static pressure.
 - 3. Label access doors according to Division 23 Section "Mechanical Identification" to indicate the purpose of access door.

G. Flexible Connections

- 1. Install flexible connectors to connect ducts to equipment.
- 2. Flexible fabric connections installed at equipment exterior to the building shall be rated UV exposure and suitable for exterior use per ASTM G155 testing requirements. Metal for these connections shall be aluminum or stainless steel, galvanized connections shall not be allowed.
- 3. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- 4. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium and high pressure fans with leaded vinyl sheet, held in place with metal straps.
- 5. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

H. Flexible Duct

- 1. Connect terminal units to supply ducts directly or with maximum 36-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- 2. Fittings on terminal units and on sheet metal duct shall have flexible duct core slipped over duct and coupling or clamp tightened, then connection sealed with sealant. Insulation of flexible duct shall be slipped over connection to point where insulation abuts terminal unit or insulation on duct.
- 3. These insulation connections shall be sealed by embedding fiberglass tape in the sealant and coating with more sealant to provide a vapor barrier.
- 4. The terminal ends of the duct core shall be secured by compression coupling or stainless steel worm gear type clamp.

5. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
6. Support flexible ducts as per SMACNA standards to prevent sags, kinks and to have 90 degree turns.

I. Flexible Duct Elbow Supports

1. Install flexible duct elbow supports in accordance with manufacturer's instructions.
2. Install flexible duct elbow supports over outer jacket of flexible ducts to form smooth, 90-degree bends to eliminate flexible duct kinks and airflow restrictions.
3. Make bends in flexible ducts with minimum of 1-duct diameter centerline radius.
4. Install flexible duct elbow supports at flexible duct 90-degree bends at following locations:
 - a. Diffusers.
 - b. Grilles.
 - c. Registers.
 - d. Duct take-offs and taps.
 - e. Air devices with round inlets and outlets.
 - f. HVAC equipment with round inlets and outlets.
 - g. As indicated on the Drawings.

J. Balancing Dampers

1. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing.
2. Provide all dampers furnished by the BAS Provider in strict accordance with manufacturer's written installation instruction and requirements of these Specifications.

K. Backdraft Dampers

1. Provide backdraft dampers on exhaust fans or exhausts ducts where indicated. Install dampers so that they will open freely.

L. General Installation

1. All installation shall be in accordance with manufacturer's published recommendations.
2. Furnish and install Ventlok No. 699 instrument test holes in the return air duct and in the discharge duct of each fan unit.
3. Access doors as specified elsewhere shall be provided for access to all parts of the fire and combination fire and smoke dampers. Doors shall open not less than 90 degrees following installation and shall be insulated type where installed in insulated ducts.

3.2 TESTING

- A. After each fire damper, smoke damper and combination fire and smoke damper has been installed and sealed in their prescribed openings and prior to installation of ceilings, Contractor shall activate part or all dampers as required to verify "first-time" closure.

- B. Activation of damper shall be accomplished by manually operating the resettable link, disconnecting the linkage at the fire damper fusible link, and manually operating the fire/smoke damper through the pneumatic or electronic controls as appropriate.
- C. Failure of damper to close properly and smoothly on the first attempt will be cause to replace the entire damper assembly.
- D. Coordinate smoke damper system interlock requirements with the fire alarm system.

END OF SECTION

SECTION 23 34 39
HIGH VOLUME, LOW SPEED FANS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all work required to provide and install the HVLS Fans indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section:
 - 1. High Volume, Low Speed Fans (HVLS Fans)

1.2 REFERENCES

- A. The most recently adopted of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings
 - 2. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings
 - 3. AMCA 99 - Standards Handbook
 - 4. ACMA 203 - Fan Application Manual - Field Performance Measurements
 - 5. AMCA 204 - Balance Quality and Vibration Levels For Fans
 - 6. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
 - 7. AMCA 300 - Reverberant Room Method for Sound Testing of Fans
 - 8. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data
 - 9. NEMA MG1 - Motors and Generators
 - 10. NFPA 13 - Standard for the Installation of Sprinkler Systems
 - 11. NFPA 70 - National Electrical Code
 - 12. UL 507 - Standard for Safety Electric Fans

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated
 - 2. Certified fan sound-power ratings
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories
 - 4. Material thickness and finishes, including color charts
 - 5. Fan speed controllers
 - 6. Installation manuals
- B. 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. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints.
 - 3. Air Velocity Profiles: CFD analysis showing airflow velocities (ft/min) in designed space.
- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspension assembly members.
 - 2. Size and location of initial access modules for acoustical tile.
 - 3. Open-Ceiling items including light fixtures, diffusers, grilles, speakers, sprinklers, and special moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For HVLS to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal. The sound power levels must not exceed those indicated on Drawings.

- C. Fabrication: Conform to AMCA 99.
- D. Performance Base: 50 feet above sea level.
- E. Fans shall be capable of operating stably at all speeds.
- F. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- G. UL Standard: HVLS fans shall comply with UL 507.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

- A. Coordinate size and location of structural-steel support members.

1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of fans that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For motor, including controls: 5 years from substantial completion.
 - b. For Hub and Airfoils: Lifetime warranty for parts.
 - c. For Labor: One year from substantial completion.

PART 2 - PRODUCTS

2.1 HIGH VOLUME, LOW SPEED FANS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MinkaAire

3. Hunter Fan
 4. MacroAir Fans
 5. Skyblade
- C. Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of large-diameter blade set, direct-driven or gear-driven motor, with variable-speed motor controller.
 - D. Performance: See schedule on drawings for performance information.
 - E. Hub: Fabricated of high strength steel or aluminum. The hub shall be secured to the output shaft of the gearbox and shall incorporate retaining clips that shall restrain the hub/airfoil assembly.
 - F. Airfoils: The fan airfoils shall be constructed out of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with stainless steel retainers. Each airfoil shall be equipped with a winglet to enhance efficiency and effectiveness of the fan.
 - G. Gearbox: The gearbox shall incorporate a cast iron housing, double lip output seals, and a solid output shaft. Gearbox shall be sealed for ease of service with lifetime synthetic oil to exclude contaminants.
 - H. Mounting: The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure. All mounting bolts shall be SAE Grade 8 or equivalent.
 - I. Safety cables: The fan shall be equipped with a safety cable that provides an additional means of securing the fan assembly to the building structure.

2.2 MOTORS

- A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.

- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps as required for stability.
- C. Support suspended units from structure using manufacturers provided mounting arm.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 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."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and verify connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Verify lubrication for bearings and other moving parts.
 - 6. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 23 37 00
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the air inlets and outlets indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section:
 - 1. Grilles, Registers and Diffusers
 - 2. Louvers

1.2 REFERENCES

- A. Equipment and Installation shall meet the requirements outlined in the following references:
 - 1. ACGIH: American Conference of Governmental Industrial Hygienists
 - 2. AMCA: Air Movement and Control Association
 - 3. NFPA: National Fire Protection Association
 - 4. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.
 - 5. UL: Underwriters Laboratories, Inc.
 - 6. AMCA 500 – Test Method for Louvers, Dampers and Shutters
 - 7. ANSI/NFPA 90A – Installation of Air Conditioning and Ventilating Systems
- ASHRAE 70 – Method of Testing for Rating the Air Flow Performance of Outlets and Inlets

1.3 SUBMITTALS

- A. Product Data: (For Each Product)
 - 1. Catalog cut-sheets
 - 2. Indicate materials of construction, finish and mounting details
 - 3. Mounting details
 - 4. Installation instructions

5. Performance data (at actual operating conditions)
 - a. Throw and drop
 - b. Static-pressure drop
 - c. Noise ratings
 6. Inlet and Outlet Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Submit color and finish samples for all louvers.

1.4 QUALITY ASSURANCE

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Grilles, registers and diffusers shall be as scheduled on the Drawings. Grilles, registers and diffusers shall be provided with sponge rubber or soft felt gaskets where noted on the Drawings. Grilles, slot diffusers and laminar flow bars shall not be internally insulated.
- C. If a manufacturer other than the one scheduled is used, the sizes shown on the Drawings shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made. Selections shall meet the manufacturer's own published data for the above performance criteria. The throw shall be such that the velocity at the end of the throw in the five (5) foot occupancy zone will not exceed 50 fpm or be less than 25 fpm except where indicated otherwise. Noise levels shall not exceed those published in ASHRAE for the type of space being served (NC level).
- D. Locations of air distribution devices on Drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be influenced by the established general pattern of the lighting fixtures or architectural reflected ceiling plan, but primarily located to maintain proper air distribution. Where called for on Drawings, grilles, registers and diffusers shall be provided with deflecting devices and manual dampers. These grilles, registers, and diffusers shall be the standard product of the manufacturer, and subject to review by the Architect.
- E. Provide a frame compatible with the type of ceiling or wall in which the devices are installed. Refer to Architectural Drawings for exact type of ceiling specified.
- F. Coordinate color and finish of the devices with the Architect.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS, AND DIFFUSERS

- A. Acceptable Manufacturers
 1. Anemostat
 2. Carnes
 3. Krueger

4. Nailor
5. Price
6. Titus
7. Tuttle & Baily

B. Square Panel Face diffuser – Supply and Return

1. Architectural diffuser with a square panel face, centered within a square housing. The exposed surface of the face panel shall be smooth, flat and free of visible fasteners.
2. The diffuser shall have a 22-gauge steel face panel that captures a secondary 22-gauge panel. The panel shall project a maximum of 1/4" below the outside border of the diffuser.
3. For area of high moisture content or requiring non-ferrous materials, the diffuser shall be constructed of 22-gauge aluminum. This includes a 22-gauge aluminum panel that captures a secondary panel.
4. The face panel size shall be a minimum of 18" x 18" for 24" x 24" diffusers and 9" x 9" for 12" x 12" diffusers.
5. Accessories:
 - a. Drawings that depict two-way and three-way throw options are achieved with the use of filler panel (where required) for directional throw diffusers.
 - b. Opposed blade volume dampers shall be provided with the diffuser, if noted on the Drawings. The damper shall be operational from the face of the diffuser.
 - c. Although the manufacturers show this model being used only as a supply air device, this same diffuser can also be used as a return air device. The neck connection shall be the largest available neck size provided by the manufacturer.

C. Perforated Face Ceiling diffusers – Return and Exhaust

1. Perforated face with back pan, removable face, and neck sizes as indicated on Drawings. Diffuser is available with round or square neck sizes.
2. Perforated face to consist of 3/16" diameter holes on 1/4" staggered centers. A minimum of 51% free area shall be available.
3. Fabricate completely of 22-gauge steel with a baked enamel off-white finish.
4. The diffuser shall have a 22-gauge steel face panel that captures a secondary 22-gauge panel. The panel shall project a maximum of 1/4" below the outside border of the diffuser.
5. For areas of high moisture content or requiring non-ferrous materials, the diffuser shall be constructed of 22-gauge aluminum.
6. Accessories:
 - a. Opposed blade volume dampers shall be provided with the diffuser, if noted on the Drawings. The damper shall be operational from the face of the diffuser.

D. Perforated Face Ceiling Diffusers – Supply

1. Perforated face with fully adjustable pattern and removable face.
2. Perforated face to consist of 3/16" diameter holes on 1/4" staggered centers. A minimum of 51% free area shall be available.
3. Fabricate completely of 22-gauge steel with a baked enamel off-white finish.
4. The diffuser shall have a 22-gauge steel face panel that captures a secondary 22-gauge panel. The panel shall project a maximum of 1/4" below the outside border of the diffuser.
5. For areas of high moisture content or requiring non-ferrous materials, the diffuser shall be constructed of 22-gauge aluminum.
6. Provide multi-louvered equalizing grid where noted on Drawings.
7. Accessories:
 - a. Opposed blade volume dampers shall be provided with the diffuser, if noted on the Drawings. The damper shall be operational from the face of the diffuser.

E. Registers and Grilles – Supply

1. Aluminum or Steel, as scheduled.
2. 1 1/4" wide borders to have a minimum of thickness of 0.032" for sizes under 24" x 24". Larger sizes shall be constructed of 0.040" or thicker material.
3. Screw holes to be used for mounting, shall be countersunk.
4. Blades shall be spaced on 3/4" centers.
5. Opposed blade damper with removable key operator, operable from face, shall only be provided with registers or as noted on the Drawings.

F. Registers and Grilles – Return and Exhaust

1. Aluminum or Steel, as scheduled.
2. 1 1/4" wide borders to have a minimum thickness of 0.032" for sizes under 24" x 24". Larger sizes shall be constructed of 0.040" or thicker material.
3. Screw holes to be used for mounting, shall be countersunk.
4. Blades shall be spaced on 3/4" centers.
5. Opposed blade damper with removable key operator, operable from face shall only be provided with registers or as noted on the Drawings.

G. Egg Crate Grille – Return and Exhaust

1. Fixed series of cubes comprised of 1/2" x 1/2" x 1" aluminum strips.

2. Fabricate 1" margin aluminum frame.
3. Fabricate of aluminum with factory baked enamel finish.
4. Provide square uniform height plenum for ducted return and exhaust application of scheduled neck size.

2.2 LOUVERS

A. Acceptable Manufacturers

1. American Warming and Ventilating
2. Anemostat
3. Arrow
4. Greenheck
5. Pottorff
6. Ruskin
7. Tamco
8. United Enertech

B. Performance

1. Pass 750 feet per minute free velocity with less than 0.10" of water pressure drop, based in accordance with AMCA 500
2. Water penetration less than 0.025 ounce of water per foot of free area at 900 feet per minute
3. Provide a minimum of 45% free area

C. Frame

1. Material: Extruded aluminum, Alloy 6063-T5
2. Wall Thickness: 0.081 inch, nominal
3. Depth: 6 inches
4. Furnish with exterior angle flange for installation

D. Blades

1. Depth: 6 inches
2. Style: Drainable

3. Material: Extruded aluminum, Alloy 6063-T5

4. Wall Thickness: 0.081 inch, nominal

5. Angle: 37.5 degrees

6. Centers: 6 inches, nominal

E. Bird Screen

1. Material (intake): Aluminum, 3/4" x 0.051", expanded

2. Material (exhaust): Aluminum, 1/2" mesh x 0.063"

3. Frame: Removable, rewirable

F. Construction

1. All welded construction

2. Drain gutter in head frame and each blade

3. Downspouts in jambs to drain water from louver for minimum water to cascade from blade to blade

G. Accessories

1. Blank-off panels: 1", aluminum skin, insulated core, factory installed with removable screws and neoprene gaskets.

2. Hinged frame: Continuous piano hinge attached to angle subframe

3. Front Security Bars: Aluminum, 3/4" x 1/2", welded to louver.

4. Filter Racks: Formed channel racks to accept standard 1" thick filters. Unused bottom portion blanked off with 0.040 inch aluminum sheet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

2. All installation shall be in accordance with manufacturer's published recommendations.

B. Diffusers

1. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, reflected ceiling plans, symmetry, and lighting arrangement.
2. Install air outlets and inlets to ductwork with airtight connection.
3. Provide balancing dampers on duct take-off to diffusers, grilles and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
4. Provide all specialties and frames for air distribution devices as required for proper installation in ceiling type as indicated on Architectural Drawings. Provide all cutting and patching of T-bars, gypsum board, and other ceiling systems as required for installation of air devices.

C. Special Requirements

1. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09.

END OF SECTION

SECTION 23 72 00
ENERGY RECOVERY VENTILATION UNITS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following equipment indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section:
 - 1. Fixed-plate total air-to-air heat exchanger elements
 - 2. Air filters and frames
 - 3. Blower fans and motors
 - 4. Electrical characteristics
 - 5. Operational controls

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. 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.
- B. ARI Compliance: Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Rating Air-to-Air Energy Recovery Equipment."
- C. UL Compliance: Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators".
- D. NFPA 90A AND 90B for 25/50 fire/smoke spread index ratings using UL Standard 723 testing.

1.4 COORDINATION

- A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other trade construction within ceiling space, including light fixtures, ductwork, fire alarm, plumbing piping, wall and partition assemblies.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- C. Coordination Drawings: Include with ductwork coordination-layout drawings. Provide plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which equipment or suspension systems will be attached.
 - 3. Attaching ductwork.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Fixed-Plate Total Heat Exchangers:
 - a. Core: ten (10) years.
 - b. Remaining items: two (2) years

PART 2 - PRODUCTS

2.1 FIXED-PLATE TOTAL HEAT EXCHANGERS

- A. Acceptable Manufacturers: Subject to compliance with requirements:
 - 1. RenewAire, LLC.
 - 2. Lennox, Inc.
 - 3. Mitsubishi Electric Sales Canada Inc.
 - 4. Broan
 - 5. Fantech
 - 6. Prior approved equal.
- B. Construction:
 - 1. Casing: Galvanized, 20-gauge steel, with lapped corners.
 - 2. Fixed-plate energy-exchange element. Energy-exchange module shall be of fixed-plate cross-flow construction, with no moving parts.

3. Flange components shall be provided suitable for connection of ductwork.
 4. Access doors shall provide easy access to blowers, energy transfer elements, and filters. Panel shall be gasketed to provide air-tight seal.
 5. Case walls and doors shall be insulated with 1" FSK high-density board insulation, without exposure of fresh air to glass fibers.
- C. Plates: Evenly spaced and sealed and arranged for cross or counter airflow.
1. Plate Material: Chemically treated resin-coated paper with selective hygroscopicity and moisture permeability, and gas barrier properties.
 2. Capable of transferring both sensible and latent energy between air streams. Latent energy transfer shall be accomplished by direct water vapor transfer from one air stream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.
 3. Water vapor transfer shall be through molecular transport by hygroscopic resin and shall not be accomplished by "porous plate" mechanisms. Exhaust and fresh airstreams shall at all times travel in separate passages, and airstreams shall not mix.
 4. Airflow through the energy exchange element shall be laminar, with no deposition of particulates on the interior of the energy exchange plate material.
- D. Disposable Panel Filters:
1. Energy-exchange element shall be protected by pleated, disposable filters; one for outdoor air, one for return air, directly upstream of exchange element.
 2. Comply with NFPA 90A.
 3. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 4. Provide filter holding frames arranged for flat or angular orientation, with access doors on side of unit for service. Filters shall be removable from one side or lift out from access plenum.
 5. Factory-fabricated, viscous-coated, flat-panel type.
 6. Size: 20"x20"x2" thick, pleated media.
 7. Initial Resistance: 0.10" wc.
 8. Recommended Final Resistance: 0.25" wc.
 9. Arrestance (ASHRAE 52.1): 80.
 10. MERV: 8.
 11. Media: Interlaced glass fibers sprayed with nonflammable adhesive.

12. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

2.2 CAPACITIES AND CHARACTERISTICS

- A. Performance capacities, characteristics, and operating conditions: See equipment schedule on drawings.
- B. Blower Fans:
 1. Forward curved centrifugal with direct drive.
 2. Internally vibration isolated from casing.
 3. Motors shall be thermally protected with automatic reset, or supplied with starters.
 4. Wire motors and controls so only external connections are required during installation.
 5. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for HVAC Equipment."
 6. Motor Sizes: Minimum size as scheduled on drawings. No driven load will require motor to operate in service factor range above 1.0.
- C. Electrical:
 1. Single point power connection.
 2. Internal 24 volt control power transformer.
 3. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections
- D. Operation Controls:
 1. See Notes under equipment schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow all manufacturer's installation instructions.
- B. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in cross-flow directions. Verify duct air streams and flow directions prior to making ductwork connections.
- C. Suspended Units: Suspend units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

- D. Install units with clearances for service and maintenance. Verify full travel of access doors for filter and blower fan sections.
- E. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.2 CONNECTIONS

- A. Comply with requirements for ductwork specified in Division 23 Section "Metal Ducts."
- B. Install piping adjacent to machine to allow service and maintenance.

END OF SECTION

SECTION 23 81 13
PACKAGED TERMINAL AIR CONDITIONERS, THROUGH-WALL UNITS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following packaged terminal air conditioners indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1.3 SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings
 - 1. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal and control wiring.
- C. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.
- D. Product Test Reports: For tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Field quality-control reports
- F. Sample Warranty: for special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from the date of Substantial Completion, including components and labor.
 - 2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial completion, including only components and excluding labor.
 - 3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Whirlpool
- B. Amana
- C. Friedrich
- D. LG
- E. Prior approved equal

2.2 MANUFACTURED UNITS

- A. Description: Factory-assembled and tested, self-contained, packaged, terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with cored-connected hardwired chassis.
- 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 – "Outdoor Air Quality," Section 5 – "Systems and Equipment," Section 6 – "Ventilation Rate Procedures," and Section 7 – "Construction and Startup."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1
- E. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.
- F. UL listed and ETL performance certified.

2.3 CHASSIS

- A. Cabinet: 0.052 inch thick galvanized steel with removable front panel with concealed latches.
1. Mounting: Wall with wall sleeve.
 2. Top: Flat
 3. Discharge Grille: Punched-louver discharge grille allowing four-way discharge air pattern, tamperproof, and carrying a flame test rating in accordance with UL Standard 494.
 4. Louvers: Extruded aluminum with enamel finish color.
 5. Finish: Baked enamel
 6. Access Door: Hinged door in top of cabinet for access to controls.
 7. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
 8. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 9. Electrical Subbase: Enameled steel with four adjustable leveling feet and adjustable end plates with factory-installed and -wired, fused disconnect switch and receptacle sized for unit.
 10. Hydronic Subbase: Enameled steel with six adjustable leveling feet and adjustable end plates with two row NPS 5/8 (DN 18) copper tube, aluminum-plate finned coil for use with hot water or steam, normally open normally closed low-voltage electric valve for hot water steam and provision for mounting receptacle ,with factory-installed and -wired, fused disconnect switch and receptacle sized for unit.
 11. Wall Sleeves: Molded fiberglass-reinforced polyester.
- B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor and hermetically sealed scroll compressor with vibration isolation and overload protection.
1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil.
 2. Accumulator
 3. Constant-pressure expansion valve
 4. Reversing valve
 5. Charge: R-410A
- C. Indoor Fan: Forward curved, centrifugal; with single-speed motor and positive-pressure ventilation damper with concealed manual electric operator.
- D. Filters: Washable polyurethane in molded plastic frame.

- E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation
 - 1. Comply with ASHRAE 62.1 for drain pan construction and connections.
- F. Outdoor Fan: Forward curved, centrifugal driven by indoor fan motor.
 - 1. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - a. Fan Motors: Permanently lubricated split capacitor.
 - b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0
 - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical section.

2.4 HEATING

- A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contractor and high-temperature-limit switch.

2.5 CONTROLS

- A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling and fan operation. Include the following features:
 - 1. Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F outdoor air temperature.
 - 2. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F and to supplemental heating below plus 25 deg F.
 - 3. Temperature-Limit Control: Prevents occupant from exceeding present setback or setup temperature.
 - 4. Building Automation System Interface: Allows remote on-off control with setback temperature control.
 - 5. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on indoor outdoor coil and reverses unit to melt frost.
- B. Remote Control: Standard unit-mounted controls with remoted-mounted, low-voltage, adjustable thermostat with heat anticipator; heat-off-cool-auto heat-off-cool switch; and on-auto fan switch.
- C. Outdoor Air: Motorized intake damper. Open intake when unit indoor-air fan runs.
- D. Outdoor Air: Manual intake damper

2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."

- B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
- B. Install wall sleeves in finished wall assembly, seal and weatherproof. Joint sealant materials and applications are specified in Section 079200 "Joint Sealants."
- C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Unit is level on base and is flashed in exterior wall.
 - 4. Unit casing has no visible damage.
 - 5. Compressor, air-cooled condenser coil, and fans have no visible damage.
 - 6. Labels are clearly visible.
 - 7. Controls are connected and operable.
 - 8. Shipping bolts, blocks and tie-down straps are removed.
 - 9. Filters are installed and clean.
 - 10. Drain pan and drain line are installed correctly.
 - 11. Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical sections.
 - 12. Installation: Perform startup checks according to manufacturer's written instructions, including the following:
 - a. Lubricate bearings on fan

- b. Check fan-wheel rotation for correct direction without vibration and binding.
- 13. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- 14. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. After operational test, change filters.
- D. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit breaker trip ranges as indicated.

END OF SECTION

**SECTION 23 82 00
TERMINAL HEATING EQUIPMENT**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all work required to provide and install the following Terminal Heating Devices indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment Included in This Section
 - 1. Electric Terminal Heat
 - a. Unit Heaters
 - b. Cabinet Unit Heaters
 - c. Duct Mounted Heating Coils
 - 2. Gas Fired Terminal Heat
 - a. Unit Heaters
 - b. Radiant Tube Heaters

1.2 SUBMITTALS

- A. Product Data: Catalog cuts, specifications, installation and maintenance instructions for each type of heater specified.
- B. Schedule: List manufacturer, unit type, model number, and performance data for each unit heater.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Heaters shall be UL listed.
- B. Certification: Affidavit from finned tube radiation manufacturer certifying that element has been tested in accordance with the requirements of IBR Testing and Rating Standard for finned tube radiation.

1.4 MAINTENANCE

- A. Special Tools: One (1) tool for each type and size vandal resistant fastener.

PART 2 - PRODUCTS

2.1 CONFIGURATION AND PERFORMANCE

- A. Refer to the equipment schedules for additional configuration and performance requirements.

2.2 ELECTRIC TERMINAL HEAT

- A. Electric Unit Heaters

- 1. Acceptable Manufacturers

- a. Berko
- b. Brasch
- c. Indeeco
- d. King Electric
- e. Markel
- f. Modine
- g. Q-Mark
- h. Raywall
- i. Redd-I
- j. Stelpro
- k. Trane
- l. TPI Corp

- 2. Unit Casing: Constructed of steel sheet formed, reinforced, and braced for rigidity, with steel louvers or deflectors with sufficient rigidity to prevent vibration at all fan speeds.

- a. Materials:

- 1) Galvanized Steel Sheet: ASTM A 653, coating designation G90.
- 2) Cold-Rolled Steel Sheet: ASTM A 366, cleaned, degreased and phosphatized.

- b. Factory Finish: Minimum two (2) coat baked enamel finish on exposed surfaces, color as directed.

- 3. Provide with discharge nozzle for units to throw air from the specified mounting height to the floor or as specified on the drawings. At a minimum, units shall include the following:

- a. Horizontal Delivery Units: Adjustable horizontal and vertical louvers.
- b. Vertical Delivery Units: Louvered deflector mounted outside fan orifice.

- 4. Provide all necessary mounting hardware to support the heater.

- B. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550° F at any point during normal operation.

- C. Circuit Protection: One (1)-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.

- D. Wiring Terminations: Stainless-steel or corrosion-resistant material.

- 1. Fan Assembly (Refer to schedule for fan type)

- a. Fan (Propeller): Multiple blade propeller type, statically and dynamically balanced, and directly connected to electric motor.

- b. Fan (Blower): Double width, double inlet (DWDI), forward curved, belt driven, assembly with spider ball bearings.
- 2. Motor: Single phase, totally enclosed electric motor of the permanent split capacitor or shaded pole type, with resilient mounting, terminal box for wiring connections, built-in overload protection, and ball or sleeve bearings with oilers, or permanently lubricated bearings.
- 3. Refer to schedule for control type and electrical requirements for the unit.

E. Electric Cabinet Unit Heaters

- 1. Acceptable Manufacturers
 - a. Berko
 - b. Brasch
 - c. Indeeco
 - d. King Electric
 - e. Markel
 - f. Q-Mark
 - g. Raywall
 - h. Redd-I
 - i. Stelpro
 - j. Trane
 - k. TPI Corp
- 2. Unit Casing: Constructed of steel sheet formed, reinforced and braced for rigidity, with stamped grilles.
 - a. Materials:
 - 1) Galvanized Steel Sheet: ASTM A 653, coating designation G90.
 - 2) Cold-Rolled Steel Sheet: ASTM A 366, cleaned, degreased and phosphatized.
 - b. Factory Finish: Minimum two (2) coat baked enamel finish on exposed surfaces, color as directed.
 - c. Insulation: Insulate interior surfaces of casing panels with 1/2 inch glass fiber meeting NFPA 90A requirements.
 - d. Vertical Units: Minimum 18 gauge construction with removable front panel.
 - e. Horizontal Units: Minimum 18 gauge construction with hinged bottom panel.
- 3. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550° F at any point during normal operation.
 - a. Circuit Protection: One (1)-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
 - b. Wiring Terminations: Stainless-steel or corrosion-resistant material.
- 4. Fan Assembly: Blow thru design.
 - a. Fans: Forward curved centrifugal type, double width, statically and dynamically balanced, and directly connected to electric motor.

5. Motors: Three (3) speed, single phase electric motors of the permanent split capacitor or shaded pole type, with resilient mounting, built-in overload protection with automatic reset, and ball or sleeve bearings with accessible oilers, or permanently lubricated bearings.
 6. Filter Section: Built-in filter frame mounted at air inlet with disposable air filters.
 - a. Vertical Units: Filters removable without removing front panel for cabinet type units.
 - b. Horizontal Units: Filters removed by pivoting hinged bottom panel.
- F. Refer to schedule for cabinet style, control type and electrical requirements for the unit.
- G. Electric heating coil
1. Acceptable Manufacturers
 - a. Brasch
 - b. Chromalox
 - c. Indeeco
 - d. Thermolec
 - e. Stelpro
- H. Heater shall be duct mounted and open element or finned tubular construction. Heater to be flanged or slip-in style. Provide all necessary mounting hardware for installation.
- I. Voltage, physical size, wattage, number of steps and with accessories as noted on the drawings or specified. Heater shall be of design for mounting in a horizontal air flow through heater.
- J. Resistance coils shall be fabricated of 80 percent nickel and 20 percent chromium wire, insulated by means of best quality ceramic terminal insulators and bushings from rigid, reinforced aluminized steel frame. Provide coil support brackets, reinforced with stiffening ribs and gussets, on maximum 4 inch centers. All coil terminals and fasteners shall be stainless steel.
- K. Provide heaters with an automatic reset thermal cutout for primary protection installed in the control circuit and heat limiters installed in the power legs for secondary protection. Protection devices shall be serviceable through heater terminal box, without removing heater from duct.
- L. Provide heater with integral terminal box, for making connections and enclosing accessories. Fabricate box from heavy gage aluminized steel, with a dust tight cover. Furnish continuous hinged type door, when fuses are installed in box. Provide insulated terminal boxes for installation in air-conditioning ducts running through warm, humid, non-conditioned spaces. All exposed surfaces shall be given a factory applied two coat baked enamel finish.
- M. Air flow switch: Provide a remote airflow switch located downstream from heater, in the positive pressure ductwork, with an adjustable pressure range from 0.07 inch to 5.0 inch W.C. Switch shall be of the combined static and velocity pressure type.
- N. Refer to schedule for element type, duct installation type and control type for the unit.

2.3 GAS FIRED TERMINAL HEAT

A. Gas Fired Unit Heaters

1. Acceptable Manufacturers
 - a. Detroit Radiant
 - b. Lennox
 - c. Modine
 - d. Reznor
 - e. Sterling
 - f. Trane
2. Unit Casing: Constructed of steel sheet formed, reinforced, and braced for rigidity, with steel louvers or deflectors with sufficient rigidity to prevent vibration at all fan speeds.
3. Materials:
 - a. Galvanized Steel Sheet: ASTM A 653, coating designation G90.
 - b. Cold-Rolled Steel Sheet: ASTM A 366, cleaned, degreased and phosphatized.
4. Factory Finish: Minimum two (2) coat baked enamel finish on exposed surfaces, color as directed.
5. Provide with discharge nozzle for units to throw air from the specified mounting height to the floor or as specified on the drawings. At a minimum units shall include the following:
 - a. Horizontal Delivery Units: Adjustable horizontal and vertical louvers.
 - b. Vertical Delivery Units: Louvered deflector mounted outside fan orifice.
6. Provide all necessary mounting hardware to support the heater.
7. Gas Fired Heat Exchanger:
 - a. The heat exchanger(s) shall be made of 18 gauge aluminized steel tubes and headers (opt 409 stainless steel). The thermal efficiency of the unit(s) shall be a minimum of 80% efficient for all air flow ranges. Each heat exchanger tube shall be individually and directly flame-fired. The heat exchanger tube shall be crimped to allow for thermal expansion and contraction. The flue collector box shall be made of 20 gauge aluminized steel.
 - b. The heat exchanger(s) seams and duct connections shall be certified to withstand 0.9" W.C. external static pressure without burner flame disturbance.
 - c. The burner(s) shall be in-shot type, directly firing each heat exchanger tube individually and is (are) designed for good lighting characteristics without noise of extinction for both natural and propane gas.
 - d. The ignition controller(s) shall be 100% shut-off with continuous retry. The gas pressure shall be between 6-7" W.C for natural gas. (opt) The gas pressure shall be 11-14" W.C. for propane gas.
 - e. The solid state ignition system shall directly light the gas by means of a direct spark igniter each time the system is energized.
 - f. The unit gas controls shall be provided with the following:
 - 1) (option) Single-stage gas controls with a single-stage combination gas control, an ignition control, and a single-stage low voltage thermostat. The unit fires at 100% full fire based on a call for heat from a room thermostat.
 - 2) (option) Two-stage gas controls with a two-stage combination gas control, an ignition control, and a two-stage low voltage thermostat. The unit fires at 50% fire on low stage or 100% fire on high stage of the unit based on the call for heat from either a room or duct thermostat.

- g. An automatic reset high limit switch mounted in the air stream to shut off the gas supply in the event of overheating.
 - h. A time delay relay that delays the start of the air mover to allow the heat exchanger a warm-up period after a call for heat. The time delay relay shall also continue the air mover operation after the thermostat has been satisfied to remove any residual heat in the heat exchanger.
 - i. The unit shall be orificed for up to 2000' elevation above sea level.
8. Fan Assembly (Refer to schedule for fan type)
- a. Fan (Propeller): Multiple blade propeller type, statically and dynamically balanced, and directly connected to electric motor.
 - b. Fan (Blower): Double width, double inlet (DWDI), forward curved, belt driven, assembly with spider ball bearings.
9. Motor: Single phase, totally enclosed electric motor of the permanent split capacitor or shaded pole type, with resilient mounting, terminal box for wiring connections, built-in overload protection, and ball or sleeve bearings with oilers, or permanently lubricated bearings.
10. Refer to schedule for control type and electrical requirements for the unit.

2.4 GAS FIRED RADIANT TUBE HEATERS

1. Acceptable Manufacturers
 - a. Detroit Radiant
 - b. Roberts Gordan
 - c. Schwank
2. Low intensity infrared heating system consisting of burner, controls, heating elements, and heat reflectors. Burner shall be sealed combustion type designed for ducted combustion air and exhaust.
3. Casing: The controls, combustion air blower and burner shall be housed in a water-resistant casing, providing weatherproof protection. The burner and control box casing shall be constructed of minimum 20 gauge aluminized steel with a baked enamel finish.
4. Heat Exchanger: The heat exchanger tubes and combustion chamber shall be constructed of minimum 16 gauge, 4" O. D. aluminized steel. The first combustion tube for gas inputs 150,000 Btuh and greater shall be 16 gauge 4" O.D. titanium aluminized steel. The heat exchanger tubes must be used in conjunction with reflectors. The reflector can be adjusted from 0° to 45° from the horizontal plane. Reflectors shall be of bright polished aluminum.
5. Controls: Input power to the infrared heater(s) shall be 115V/60Hz/1ph. Heater(s) shall be equipped with a direct four (4) trial (three (3) retrieval), 100% shut-off hot surface ignition control system with a separate flame sensor. Infrared heater(s) shall be equipped with a 115V/25V control transformer. Provide with low voltage thermostat. Thermostat shall operate on 25V. Heater(s) will be equipped with a pre-purge mode, a differential pressure switch, and an indicator light to prove proper operation of the combustion air blower. All controls shall be rated for a maximum inlet pressure of 1/2 PSI gas pressure.

6. Motor: Each heater shall have a single motor. The combustion air blower motor shall be totally enclosed in the control box and the motor shall be protected by a thermal overload switch.

B. Gas Fired Duct Furnace

1. Acceptable Manufacturers
 - a. Lennox
 - b. Modine
 - c. Reznor
 - d. Sterling
 - e. Thermotek
 - f. Trane
2. Furnace section with 80% minimum efficiency provided by an indirect-fired heat exchanger with dimpled tube pattern for efficient heat transfer.
3. The unit casing shall be designed for the venting/ combustion air arrangement to be separated from the room atmosphere. The unit shall have a factory mounted power exhauster enclosed in the unit casing to prevent the motor from being subjected to the room atmosphere. The unit shall also include a factory mounted differential pressure switch designed to prevent pilot and main burner ignition until positive venting has been proven. All duct furnaces doors shall be fully gasketed to prevent infiltration of the room air into the combustion process. A removable gasketed door shall contain both the vent and combustion air connection collars to allow for servicing of the power exhauster.
4. The unit shall include a factory supplied dual or concentric vent kit with caps.
5. The heat exchanger(s) shall be made of 20 gauge 409 stainless steel tubes and headers. The flue collector box shall be made of 20 gauge aluminized steel.
6. The bottom of the unit shall be angled for draining any condensation to the corners of the unit. The condensation shall be removed through openings in the bottom pan. The drain pan shall be constructed of 20 gauge aluminized steel.
7. The unit gas controls shall be provided with the following:
 - a. Single-stage gas controls with ignition control.
 - b. Interface with the building automation system to allow for the unit to be enabled / disabled, setpoint adjusted, discharge air temperature monitoring and alarm monitoring.
 - c. Stand-alone control with a low voltage thermostat.
8. The unit shall be supplied with a disconnect switch to disconnect power to the unit for servicing. A single step down transformer shall be provided for all unit controls.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the Work of this section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.
- B. Finned Tube Radiation
 - 1. Enclosure Panel Lengths for Wall-to-Wall, Wall-to-Column, and Column-to-Column Installations:
 - a. Left and right end panels shall be equal in length.
 - b. Intermediate panels between left and right and panels shall be equal in length.
 - c. Intermediate panels shall be longer in length than end panels.
 - d. Intermediate panel lengths shall be consistent throughout an entire room and entire building.
 - e. Front and back panels for elements mounted in front of glass where back of radiant will be exposed.
 - 2. Secure finned tube radiation wall mounting strips, backplates, and brackets to wall construction with fasteners on maximum 2'-0" centers.
 - 3. Enclosures: Install access panels for each control, shutoff and balancing valve installed in enclosure.
 - 4. Enclosure accessories and access panels which attach to enclosure panel by means of slip joints only require vandal resistant fasteners to be installed in end caps.
 - 5. Pitch elements in direction of flow.
- C. Gas Fired Radiant Tube Heaters
 - 1. Install units per manufacturer's instructions. Maintain required clearance to combustibles.
- D. Gas Fired Terminal Heat
- E. Install gas vent piping per the requirements in Division 23 Section "Chimneys, Breechings and Stacks".

END OF SECTION

**SECTION 26 05 00
COMMON WORK RESULTS**

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes basic electrical requirements, which are applicable to all Division 26, 27 and 28 sections.
- B. Overview of Work
 - 1. Power Distribution
 - 2. Branch Power
 - 3. Equipment Connections
 - 4. Lighting and Lighting Controls
- C. In these documents, "Contractor" refers to the Electrical Contractor and all their subcontractors, unless listed otherwise. The division of Work with the electrical scope is the responsibility of the General Contractor.
- D. The Contractor is responsible for providing and installing fully functional systems.
- E. If the Work is shown on the drawings or noted in the specifications, it shall be included by the Contractor.
- F. If equipment is provided by the Contractor, it shall be installed by the Contractor, unless noted otherwise.
- G. Drawings are necessarily diagrammatic by their nature and are not intended to show every connection in detail or every conduit in its exact location. Carefully investigate structural and finish conditions and coordinate the separate trades in order to avoid interference between the various phases of Work. Organize and lay out Work so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Install all Work parallel or perpendicular to building lines unless otherwise noted.
- H. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Architect and Engineer for interpretations.
- I. All sizes as given are minimum except as noted.
- J. All materials shall be new (unless noted or stated otherwise) and free of defect.
- K. All work shall be subject to the Architect's, Engineer's, and Owner's observations from the commencement of work until the acceptance of the completed work.

1.2 RELATED WORK

- A. Applicable provisions of Division 0 and Division 1 govern work under this Section.

1.3 REFERENCES

- A. All work shall conform to the most current version of all applicable codes and standards or the version adopted by the jurisdiction.
- B. Codes
 - 1. International Building Code
 - 2. International Fire Protection Code
 - 3. International Energy Conservation Code
 - 4. NFPA – National Fire Protection Association
 - a. NFPA 70 (National Electric Code)
 - b. NFPA 72 (National Fire Alarm and Signaling Code)
 - c. NFPA 101 (Life Safety Code)
 - 5. State or City Codes for the City of Spirit Lake, IA
- C. Standards
 - 1. ANSI
- D. Governing Bodies
 - 1. Owner's Insurance Company
 - 2. State Fire Marshall
 - 3. AHJ – Authority Having Jurisdiction
 - 4. UL - Underwriters Laboratories

1.4 SUBMITTALS

- A. The review of Shop Drawings by the Engineer is for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the Plans and Specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. The Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination with the Work of all trades; and for performing all work in a safe and satisfactory manner.
- B. Refer to individual technical Specification sections for specific submittal requirements.

- C. Submission of Shop Drawings electronically in .PDF format is required.
- D. If hard copies of shop drawings are required for this project, coordinate the quantity with the Architect and General Contractor. Provide one (1) copy for the Engineer's records.
- E. The Engineer will review one (1) resubmittal for each product. If additional resubmittals are required, the Contractor shall be responsible to bear the cost for the Engineer to recheck and handle the additional shop drawing submittals. Documents will not be reviewed until payment is agreed upon.
- F. Contractor may request electronic files from the Engineer if needed to complete their Shop Drawings. An Electronic File Request Form will be sent to the contractor if files are requested and must be completed and signed before the AutoCAD files are released to the Contractor.
- G. All submittals for equipment and materials shall be reviewed and approved by the Engineer prior to the fabrication or release by the contractor. This includes the coordination of equipment between trades. The release, purchase, installation or fabrication of any items prior to the contractor receiving an approved shop drawing will be at the contractor's own risk. Any rework that results will be provided by the contractor at no cost to the Owner or design team.
- H. Submittals must be reviewed and approved by the Contractor before submitting to the Engineer.
- I. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

1.5 ELECTRONIC DOCUMENT RELEASE

- A. Electronic versions of the bid documents will be made available to the contractors for use during the bidding process and to help generate fabrication drawings for various systems. A summary of the requirements for the various document types is listed below:
 - 1. PDF
 - a. Contact the Architect to obtain a PDF version of the Bid Documents. No Document Release Form is required.
 - 2. AutoCAD
 - a. KEDbluestone Engineering can provide an AutoCAD version of the bid documents for the contractor to use for generating shop drawings and fabrication drawings. This will include plan drawings with the architectural background. The contractor is responsible for incorporating any modifications that occur during bidding by all disciplines. Details and schedules will not be included.
 - b. A document release form (see attached) will be required to be completed by the contractor to determine the version of AutoCad and drawings required. No fee is associated with these drawings.
 - 3. REVIT
 - a. The REVIT drawings will be converted to AutoCAD and then transferred to the contractor.
 - b. KEDbluestone Engineering can provide an AutoCAD version of the bid documents for the contractor to use for generating shop drawings and fabrication drawings. This will include plan drawings with the architectural background. The contractor is

responsible for incorporating any modifications that occur during bidding by all disciplines. Details and schedules will not be included.

- c. A document release form (see attached) will be required to be completed by the contractor to determine the version of AutoCad and drawings required.
- d. Submittal of the document release form fee will be required prior to the AutoCAD files being transmitted.

1.6 SUBSTITUTIONS

- A. All manufacturers listed as Acceptable Manufacturers in each specification section are considered equal to the basis of design. The basis of design is preferred and will take precedence. Any products from an alternate approved manufacturer need to meet the requirements and performance specified and shall be equal to the basis of design.
- B. The Contractor may request permission for a substitution of any item (equipment or material), subject to the following conditions:
 - 1. Submit substitution requests in writing to the Engineer, on a form supplied by the Engineer. A sample copy of this form is included at the end of this section. An electronic copy can also be provided to the Contractor by the Engineer.
 - 2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contractor documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed as well as any re-design costs incurred by the Architect or Engineer. The Contractor is also responsible for coordinating changes required by other trades.
 - 3. Any requests for alternate manufacturers must be submitted to the Architect/Engineer at least ten (10) days prior to bid day. Incomplete substitution requests will not be considered.
- C. Approval
 - 1. No work involving requests for substitution shall commence without written approval on the provided form by the Engineer.
 - 2. Any work started or material ordered/installed by the Contractor without written approval shall be removed/repaired at the sole expense of the contractor. The Contractor will also be responsible for any costs incurred by the Owner for such rework.
- D. Warranty
 - 1. Equipment warranty shall be a minimum of one (1) year from date of factory supervised startup or from the date of substantial completion, whichever is later.
 - 2. Contractor shall warranty all of their work for one (1) year from the date of substantial completion
- E. These documents are diagrammatical in nature and intended to convey scope and general arrangement of the electrical and technology systems. Not all conduits, junction boxes,

accessories, etc. are shown on Plan. If items are required to make a system fully operational but not shown on Plan or in these Specifications, they shall be included by the Contractor.

- F. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Architect and Engineer for interpretations.
- G. It is the contractor's responsibility to determine all utility routing prior to purchase and installation of material.
- H. For remodel or addition projects, the contractor shall visit and survey the site prior to submitting a bid. The contractor shall visit the site to understand the complexity of utility routing, phasing, staging, and all general installation. Submitting a bid means the contractor acknowledges the complexities of the project and has made provisions for overcoming these complexities in their bid.
- I. The Contractor shall report any discrepancies between these documents and site conditions immediately to the Engineer prior to submitting a bid or starting work. Submittal of a bid indicates that the contractor and the contractor's subcontractors have carefully and thoroughly reviewed the Drawings, Specifications, and other construction documents and have found them complete and free from ambiguities and sufficient for the purposes intended.
- J. Install all equipment per the manufacturer's requirements / recommendations.
- K. No equipment provided or installed shall contain mercury.
- L. Manufacturer / Supplier Inspection & Startup
 - 1. The following equipment shall have a factory representative perform start-up. The procedure shall be documented and submitted to the design team and Owner. Include copies of startup reports in the Operations & Maintenance Manuals.
 - a. Lighting Control Systems, including occupancy sensor controls
- M. All equipment shall be UL listed where applicable.

1.7 REGULATORY AND UTILITY REQUIREMENTS

- A. Contractor is responsible for coordinating all required site inspections by authorities having jurisdiction. Contractor shall notify General Contractor of all scheduled inspections seven (7) working days prior to site visit.
- B. Contractor is responsible for paying for all fees, permits, and inspections that are required to complete their work.
- C. Contractor shall include all work required to install new utilities and meters as shown on drawings.

1.8 PROTECTION OF FINISHED SURFACES

- A. Furnish one (1) can of touch-up paint for each different color factory finish for equipment furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.9 SEALING AND FIRESTOPPING

- A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.10 OMISSIONS

- A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Architect and Engineer to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. All equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
- B. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to panelboards, motor controllers, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.
- C. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
- D. Take such precautions as are necessary to protect apparatus and materials from damage. Damaged equipment shall be, as determined by the Owner and/or Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
- E. Protect factory finish from damage during construction operations until acceptance of the Project. Restore any finishes that become stained or damaged to Owner's satisfaction.

1.12 DIVISION OF WORK AND COORDINATION

- A. The Electrical Contractor is responsible for providing and installing power wiring up to equipment provided by others for a single point connection. Internal wiring of equipment provided by others shall be the responsibility of the manufacturer or the contractor responsible for providing and installing the equipment.
- B. Controls, disconnect switches, starters, variable frequency drives, etc. shall be provided and installed by the contractor noted on the plans and in the specifications. It is the responsibility of

the Contractor to request written clarification for any ambiguity regarding division of work and coordination at least ten (10) days prior to bid.

- C. Utilities routed within the building shall be installed in an orderly manner. All work will be coordinated with other disciplines prior to installation. The following list ranks the priority of the utilities to be installed:
 - 1. Light fixtures
 - 2. Gravity piping
 - 3. Ductwork
 - 4. Cable tray
 - 5. All other piping
 - 6. Electrical conduits
- D. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- E. Coordinate work with the Testing and Balancing (TAB) Contractor. Verify system completion to the TAB Contractor such as fire/smoke damper integration ready for testing, power provided to control panels and control devices as specified, and power provided to all equipment and dampers that are required to operate for testing and balancing. Assist the TAB Contractor as needed to complete their work.
- F. Arrange for conduit and raceway spaces, chases, slots, and openings in building structure during progress of construction, to allow for electrical installations.
- G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- H. Coordinate requirements for access panels and doors for electrical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.13 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
- B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation as applicable:
 - 1. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - 2. A control sequence describing start-up, operation, and shutdown.
 - 3. Description of the function of each principal item of equipment.

4. Installation instructions.
5. Safety precautions for operation and maintenance.
6. Diagrams and illustrations.
7. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
8. Performance data.
9. Where applicable, pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
10. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

1.14 RECORD DRAWINGS

- A. The Contractor shall maintain at least one (1) copy of the Specifications and Drawings on the job site at all times.
- B. The Architect will provide the Contractor with a suitable set of Contract Drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.
- C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
- D. At completion of the project, the Contractor shall submit the marked-up record drawings to the General Contractor and Engineer prior to final payment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conditions: Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified.
- B. Space Limitations: Equipment selected shall conform to the building features and shall be coordinated with all components. Do not provide equipment that will not meet arrangement and space limitations.
- C. Common Source: Equipment specified in Sections 262416 Panelboards, 262728 Disconnect Switches, 262730 Contactors shall be provided by the same manufacturer.

2.2 IDENTIFICATION

- A. See Electrical Section 260553 – Identification.

2.3 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations

1. Manufacturers
 - a. 3M, STI/SpecSeal, Tremco, Hilti or approved equal.
2. All firestopping systems shall be by the same manufacturer.
3. Submittals
 - a. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.
4. Product
 - a. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.
 - b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
 - c. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

B. Non-Rated Penetrations

1. Conduit Penetrations Through Below Grade Walls
 - a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
2. Conduit and Cable Tray Penetrations
 - a. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with Division 31.

3.2 CONCRETE WORK

- A. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.3 CUTTING AND PATCHING

- A. Refer to Division 1, General Requirements, Cutting and Patching.

3.4 EQUIPMENT ACCESS

- A. Install all conduit, raceways, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.5 COORDINATION

- A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.
- B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.
- C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing Contractor's expense.
- D. Coordinate clearances in front of and above electrical distribution equipment with other trades to avoid interference issues. Maintain clearances as defined in the National Electrical Code. Pipes, ducts, etc. shall not be installed above electrical distribution equipment.

3.6 SLEEVES

- A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

3.7 SEALING AND FIRESTOPPING

- A. Fire and/or Smoke Penetrations
 - 1. Install approved product in accordance with the manufacturer's instructions where a raceway (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.

2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

B. Non-Rated Surfaces

1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
2. Install escutcheons or floor/ceiling plates where conduit penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, telephone/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.8 HOUSEKEEPING AND CLEAN UP

- A. The Contractor shall clean up and remove from the premises, daily, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

3.9 TESTING

- A. Test Conditions
1. Place circuits and equipment into service under normal conditions, collectively and separately, as may be necessary to determine satisfactory operation. Perform specified tests in the presence of the Owner's representative(s). Furnish all instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the Contract Documents. Special tests on certain items are specified hereinafter.

3.10 OWNER TRAINING

- A. All training provided for the Owner shall comply with the format, general content requirements and submission guidelines specified under Section 019101, or 019102.
- B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 4 hours or for the duration noted in the technical Specifications.

3.11 NFPA 70E COMPLIANCE

- A. The Electrical Contractor will be responsible for providing ARC Flash labeling for all electrical distribution equipment installed or modified as part of this contract. This includes but is not limited to: Identification of ARC Flash Boundaries, Application of Proper labels, and Identification of Proper Labels, and Identification of Proper Personal Protective Equipment.
- B. The Contractor must ensure that personnel working on the equipment while energized are qualified to do so and are wearing the appropriate ARC Flash personal protective equipment. Documentation of this training is required.
- E. The Electrical Contractor will include in his bid the cost to hire a qualified Engineer to perform the necessary ARC Flash study.

3.12 PROJECT CLOSEOUT REQUIREMENTS

- A. Final project closeout tasks
 - 1. Deliver all spare parts listed in each specification section. Deliver to Owner chosen location.
 - 2. All equipment labeled per specifications.
 - 3. All equipment cleaned and ready for use. Install new fuses in all equipment with fuses; do not use Owner's spare fuses.
- B. Contractor requirements
 - 1. Marked up drawings and specifications provided to Engineer for incorporation of as-built drawings or to serve as the as-built drawings depending on the project requirements. As-built drawings shall be clean and legible.
 - 2. Operation and Maintenance (O & M) Manuals shall include the following:
 - a. Contractor contact for warranty work
 - b. Approved shop drawings, incorporating all review comments
 - c. Warranty copies
 - d. Equipment start-up reports
 - e. Operation and maintenance instructions
 - 3. Utility Rebate Forms
 - a. Contractor shall submit completed energy rebate forms for each piece of equipment that is eligible for a rebate. Eligible equipment shall include, but not be limited to the following:
 - 1) Interior Lighting
 - 2) Exterior Lighting
 - 3) Occupancy Sensors
 - b. Contractor to complete information regarding equipment. Submit form to Owner; Owner will complete Owner's contact information and send the completed form to the utility.

- C. Three (3) final approved O & M Manuals shall be delivered to Owner. Each manual shall be an appropriately sized three (3) ring binder with a vinyl cover and printed spine and cover labels. Each section shall have a printed divider tab. Each section shall be listed in a table of contents at the beginning of the manual.

END OF SECTION 260500

(ELECTRONIC DOCUMENT RELEASE FORM & SUBSTITUTION REQUEST FORMS ATTACHED)

Document Release Form

Information Requested:

Project Name:

Drawings Requested:

Media Type: (Check all that are applicable)

☐ AutoCAD DWG Files (Version ____)

☐ Adobe PDF Files

☐ REVIT Files (Version ____)

☐ Other

Requesting Party:

Name:

Address 1:

Company:

Address 2:

Signature:

Email Address:

Date:

Phone #:

KEDbluestone Use:

Form Sent By:

Date:

KEDbluestone Project #:

Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or sub consultants that may arise out of or in connection with your use of the electronic files. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by us and the electronic files, the signed or sealed hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display.

5518 NW 88th Street | Johnston, IA 50131 | P 515.727.0700 | F 515.727.0777 | www.KEDbluestone.com

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

SPEC. SECTION	SPEC. TITLE	PARAGRAPH	SPECIFIED ITEM

MANUFACTURER	TRADE NAME	MODEL NO.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by the substitution.

Firm

☐ Substitution Approved
☐ Substitution Approved As Noted
☐ Substitution Rejected
☐ Substitution Request Received Too Late

Date _____

Supporting Data Attached:

☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other _____

SUBSTITUTION REQUEST FORM (AFTER BIDDING)

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

PROJECT: _____

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

Proposed Substitution: _____

MANUFACTURER	TRADE NAME	MODEL NO.
_____	_____	_____

INSTALLER	PHONE NO.
_____	_____

History: ☐ New Product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days

Savings to Owner for accepting substitution: \$ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by:

Signature

Firm

Telephone

Email

Date

Engineer's Review and Action

- ☐ Substitution Approved
- ☐ Substitution Approved As Noted
- ☐ Substitution Rejected
- ☐ Substitution Request Received Too Late

Signed by:

Date

Supporting Data Attached:

- ☐ Drawings
- ☐ Product Data
- ☐ Samples
- ☐ Tests
- ☐ Reports
- ☐ Other _____

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required for furnishing and installing required wiring and cabling systems including pulling, terminating and splicing.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section
- B. Section 260533 Raceway and Boxes
- C. Section 260553 Identification
- D. NFPA 70 National Electrical Code.

1.3 SUBMITTALS

- A. Submit product data: Provide for each cable assembly type.
- B. Submit manufacturer's installation instructions. Indicate application conditions and limitation of use stipulated by product testing agency specified under Regulatory Requirements.

1.4 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper.
- C. Insulation shall have a 600 volt rating.

- D. All conductors shall be stranded.
- E. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2 BUILDING WIRE

- A. Acceptable Manufacturers: American Insulated Wire Corp., BICC General Cable Industries Inc., Cerro Wire & Cable Co. Inc., Pirelli Cable Corp., Rome Cable Corp., or Southwire Co.
- B. Single Conductor Insulated Wire.
 - 1. THHN, THW, THW-2, THWN, THWN-2, XHH, XHHW, or XHHW-2: Wiring in dry or damp locations (except where special type insulation is required).
 - 2. THWN, THWN-2, XHHW, XHHW-2: Wiring in wet locations
 - 3. THHN, THWN or THWN-2: Wiring installed in existing raceway systems (except where special type insulation is required).
 - 4. THHN, THW-2, THWN-2, XHHW, or XHHW-2: Wiring for electric discharge lighting circuits (fluorescent, HID), except where fixture listing requires wiring rated higher than 90° C.

2.3 METAL CLAD CABLE (TYPE MC)

- A. Acceptable Manufacturers: Southwire, AFC Cable Systems Inc., Coleman Cable Co.
- B. Comply with NFPA 70, Article 330.
- C. Interlocked flexible galvanized steel armor sheath, conforming to UL requirements for type MC metal clad cable.
- D. Insulated copper conductors, suitable for 600 volts, rated 90°C, one of the types listed in NFPA 70 Table 310.104(A) or of a type identified for use in Type MC cable.
- E. Internal full size copper ground conductor with green insulation.
- F. Connectors for MC cable: Bridgeport, Arlington Industries Inc.'s Saddle grip, or Thomas & Betts Co.'s Tite-Bite with anti-short bushings.

2.4 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable unless noted otherwise.
- B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
- C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

E. Mechanical Connectors:

1. Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

F. Insulated Connector Blocks:

1. Conductor count, size, and entry configuration to match application.
2. UV rated.
3. Dual rated for use with copper or aluminum conductors.
4. 600 volt, 90° C termination rating.
5. Caps for sealing wrench access port.

G. Compression (crimp) Connectors:

1. Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.

2.5 WIRE MANAGEMENT

- A. Cable Clamps and Clips, Cable Ties, Spiral Wraps, etc: Catamount/T&B Corp., or Ideal Industries Inc.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

- A. Install electrical cable, wire and connectors as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC, and as required to ensure that products serve the intended functions.
- B. Cables shall be selected on the basis of their purpose and UL listing.
1. Generally, use Types THWN, XHHW and THHN in building interiors and other dry locations.
 2. Outdoors and in underground raceways, use Type XHHW or other conductor type rated for wet location as required by NEC 300.5(B).
 3. Conductors subject to abrasion, such as in lighting poles, shall be Type XHHW, THWN or THHN.
- C. All wire and cable shall be installed in conduit. Exceptions: Type MC as specifically indicated on the drawings not to be installed in raceways.

- D. MC cable may be used in the following applications where specifically indicated in the drawings:
1. Branch circuit wiring in wood framed construction (wood joists and wood stud partitions):
 - a. Install conductors parallel with joists or studs and attach to the side of these timbers by galvanized straps spaced not more than 6 feet apart.
 - b. Install conductors through holes bored in the center of the timbers when running at right angles to joists or studs.
 - c. Do not attach the conductors to the edge of joists or studs.
 2. Branch circuit wiring in metal stud partitions:
 - a. Install conductors parallel with studs and attach to the side by galvanized straps spaced not more than 6 feet apart.
 - b. Install conductors through holes bored in the center of the metal member when running at right angles to studs.
 - 1) Conductors shall be protected by listed bushings or listed grommets covering all metal edges.
 - c. Do not attach the conductors to the edge of studs.
- E. Do not use wire smaller than 12 AWG for power and lighting circuits. Minimum size for control circuits shall be 14 AWG copper stranded.
- F. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity.
- G. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet, and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.
- H. Make conductor lengths for parallel conductors equal.
- I. Splice only in junction or outlet boxes.
- J. No conductor less than 10 AWG shall be installed in exterior underground conduit.
- K. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

3.3 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.

- B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.
- C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
- D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.
- H. Protect wiring in device and junction boxes from paint overspray. Wiring covered with paint shall be removed and replaced where needed by the Contractor.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 260504 Cleaning and Testing.

3.5 WIRE COLOR

- A. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
- B. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored ½" or ¾" tape bands at all terminals, splices and boxes. Tape bands shall be installed at every 12" for the entire visible length. Colors to be as indicated below.
- C. In new facilities, use the following color scheme:
 - 1. Black and red for single phase circuits at 120/240 volts
 - 2. Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase.
 - 3. Neutral Conductors: White for 120/208V and 120/240V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.
 - 4. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.
- D. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.
- E. Ground Conductors: Green for 2 AWG and smaller. For 1 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes.

- F. More Than One Nominal Voltage System Within A Building: Permanently post the color coding scheme at each branch-circuit panelboard.

3.6 WIRE MANAGEMENT

- A. Use wire management products to bundle, route, and support wiring in junction boxes, pullboxes, wireways, gutters, channels, and other locations where wiring is accessible.

3.7 BRANCH CIRCUITS

- A. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

END OF SECTION

SECTION 26 05 23 CONTROL CABLES

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the required remote control and signal cabling indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.
- B. Section 260533 Raceway and Boxes.
- C. Section 260553 Identification.
- D. NFPA 70 National Electrical Code.

1.3 SUBMITTALS

- A. Submit product data: Provide for each cable assembly type.
- B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.4 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper.

- C. Insulation shall have a 600 volt rating.
- D. All conductors must be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
 - 1. All conductors terminated with crimp type devices must be stranded.
 - 2. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2 REMOTE CONTROL AND SIGNAL CABLE

- A. Refer to Division 27 for requirements for cable to be used on communication systems.
- B. All other systems cabling shall meet the requirements of NEC Article 725 and the following:
 - 1. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together, shielded (where required), and covered with an overall PVC jacket.
 - a. Cable shall be Listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.
 - 2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, Listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.3 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable.
- B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

- A. Low voltage control and signal cables shall be installed in conduit. However, they may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in conduit in other sections of the specifications. See requirements for free-air cabling installation below.
- B. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.
- C. Splice only in junction boxes.

- D. Identify wire per section 260553.
- E. Neatly train and lace wiring inside boxes, and equipment.

3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor in the same raceway.

3.3 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. All splices shall be so made that they have an electrical resistance not in excess of two (2) feet (600 mm) of the conductor.
- C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- D. Thoroughly clean wires before installing lugs and connectors.
- E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.
- F. Protect wiring in device and junction boxes from paint overspray. Wiring covered with paint shall be removed and replaced where needed by the Contractor.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 260504.

END OF SECTION

**SECTION 26 05 26
GROUNDING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following grounding indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment included in this Section
 - 1. Grounding electrodes and conductors
 - 2. Equipment grounding conductors
 - 3. Bonding

1.2 REFERENCES

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All design, materials, installation and testing pertaining to grounding and bonding system shall comply with the latest edition of applicable requirements and standards addressed within the following references:
 - 1. Applicable provisions of Division 1 govern work under this Section
 - 2. Section 260519 – Low Voltage Electrical Power Conductors and Cable
 - 3. NFPA 70 - National Electrical Code
 - 4. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 5. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System
 - 6. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book)
 - 7. IEEE C2 - National Electrical Safety Code (NESC)
 - 8. UL 467 – Grounding and Bonding Equipment
 - 9. UL 497 - Protectors for Paired-Conductor Communications Circuits.

10. UL 497A - Secondary Protectors for Communications Circuits.
11. UL 497B - Protectors for Data Communications and Fire-Alarm Circuits
12. UL 1449 - Standard for Safety Surge Protective Devices
13. BICSI Telecommunications Distribution Methods Manual (TDMM), Latest Edition.
14. ANSI J-STD-607-A – Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 SUBMITTALS

- A. Product Data: Provide data for grounding electrodes and connections.
- B. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.4 QUALITY ASSURANCE

- A. See Part 3 of this Specification for system requirements and performance requirements.

1.5 SUMMARY

- A. Ground the electrical service system neutral at service entrance equipment to grounding electrode system. Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operations. Provide a completely grounded system in accordance with Article 250 of the NEC
- B. Metal water piping system(s) installed in or attached to a building or structure shall be bonded to the service equipment enclosure, the grounded conductor at the service. Where installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to the service equipment enclosure, the grounded conductor at the service. The bonding jumper(s) shall be sized in accordance with Article 250 of the NEC.
- C. Concrete reinforcing bars shall be permitted for grounding. Connect the structural metal frame to the reinforcing bars of concrete-encased electrode. Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.
- D. Provide communications system-grounding conductor at point of service entrance and connect to telecommunications grounding busbars. Bond together the communications system grounding.
- E. Bond together system service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, metal cable trays, auxiliary gutters, meter fittings, boxes, cable armor, cable sheath, ground bus in electrical rooms, metal frame of the building or structure, ground ring, lightning down lead conductor, grounding conductor in raceways and cables, receptacle ground connectors, and metallic plumbing systems.

1.6 CERTIFICATIONS

- A. Two (2) weeks prior to final inspection, submit four (4) copies of the following to the Engineer and General Contractor/Construction Manager:
 - 1. Certification that the materials and installation is in accordance with the drawings and specifications.
 - 2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.7 CLOSEOUT SUBMITTAL AND PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of grounding electrodes. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- B. Test Reports: Indicate overall resistance to ground and resistance of each electrode

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Grounding system components shall be as required to comply with the design and construction of the system indicated. Components shall be as indicated in manufacturer's submittal data.

2.2 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch minimum.
- C. Length: Ten (10) feet minimum.

2.3 MECHANICAL CONNECTORS

- A. Products:
 - 1. Ground Clamps (Cable to Pipe):
 - a. Blackburn/T&B Corp.'s GUV
 - b. Framatome Connectors/Burndy Corp.'s GAR, GD, GP, GK
 - c. OZ/Gedney Co.'s ABG, CG
 - 2. Ground Clamps (Cable to Rod):
 - a. Blackburn/T&B Corp.'s GG, GGH, JAB, JABH, GUV
 - b. Dossert Corp.'s GN, GPC

- c. Framatome Connectors/Burndy Corp.'s GP, GX, GRC
 - d. OZ/Gedney Co.'s ABG
- 3. Ground Lugs - Copper, one (1) or two (2) hole style (to suit conditions), long barrel:
 - a. Anderson/Hubbell's VERSAtile VHCL
 - b. Blackburn/T&B Corp.'s Color-Coded CTL, LCN
 - c. Framatome Connectors/Burndy's Hylug YA
 - d. Electrical Products Div./3M Scotchlok 31036 or 31145 Series
 - e. Ideal Industries Inc.'s CCB or CCBL
 - f. Thomas & Betts Corp.'s 54930BE or 54850BE Series
- B. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.
- C. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.
- D. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.4 COMPRESSION CONNECTORS

- A. The compression connectors shall be manufactured from pure wrought copper.
- B. The conductivity of this material shall be no less than 99% by IACS standards.
- C. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- D. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- E. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
- F. Each connector shall be factory filled with an oxide-inhibiting compound.

2.5 EXOTHERMIC CONNECTIONS

- A. As manufactured by Erico (Cadweld), T&B (Furseweld) or similar.

2.6 GROUND CONDUCTORS

- A. Material:
 - 1. Provide 600-volt insulated copper (aluminum not permitted) conductors having a green-colored insulation for grounding electrode and equipment grounding conductors. Use stranded conductors.
 - 2. Conduit grounding conductors shall be insulated copper conductor, green in color to size 2 AWG. Insulated conductors larger than 2 AWG shall be same as phase conductors but

identified with green or green/yellow tape at each accessible opening or location in raceway.

3. Provide bare conductors for bonding jumpers.
 4. Provide tinned copper conductors for exterior installations.
 5. Communications cable tray grounding conductors shall be a minimum of 6 AWG bare copper conductor.
- B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.
- C. Foundation Electrodes: As shown on drawings or details.
- D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

2.7 GROUNDING BUSBAR

- A. Where a field-provided ground bus or ground bar is required, use round-edge copper bar with 98 percent International Annealed Copper Standard (IACS) conductivity
- B. Size the bus for not less than 25 percent of the cross-sectional areas of the related feeder. A minimum size of ¼-inch thick by 2-inch depth by 6-inch length (minimum) is required.
1. The ground bar shall be a predrilled copper busbar provided with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
 2. The ground bar shall be tin-plated for reduced contact resistance.
 3. The ground bar shall be insulated from its support. A minimum of 2 inches separation is required. Mount the grounding busbars on insulated standoffs to ensure isolation from ground potential or stray potentials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Install grounding conductors continuous, without splice or connection, between equipment and grounding electrodes.
- C. Size: When grounding and bonding conductors are not sized on Drawings, size the grounding conductors in accordance with NEC. Size bonding jumper so that minimum cross-sectional

area is greater than or equal to that of the equivalent grounding conductor as determined from NEC.

- D. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- E. Ground connection surfaces shall be cleaned and all buried or inaccessible connections shall be made so that it is impossible to move them.
- F. Attach grounds permanently before permanent building service is energized.
- G. All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.

3.3 LESS THAN 600 VOLT SYSTEM GROUNDING

- A. System Grounding:
 - 1. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s)
 - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
- C. Provide a supplemental ground electrode and bond to the grounding electrode system. Use driven ground rod(s) on exterior of building.
- D. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors
- E. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.
- F. Conduit System:
 - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
 - 2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
 - 3. Install an insulated grounding conductor internally to all flexible metal conduits. All flexible metal conduit containing power circuits shall utilize grounding bushings. The grounding bushing shall contain a bonding jumper and shall be terminated at the equipment ground bus. The grounding conductor shall terminate at the equipment ground bus. Install external ground wire on liquid tight flexible metal conduit. Provide suitable grounding

bushing at each end of liquid tight flexible metal conduit at transformers. External ground wire shall be in addition to grounding conductors installed internal to raceway system.

4. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.4 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus.

3.5 COMMUNICATIONS SYSTEM GROUNDING

- A. Isolated (Single Point) Ground :
1. Purpose:
 - a. An isolated single point grounding system is employed for installations utilizing sensitive electronic, data processing or communications equipment.
 - b. This single ground bus is not connected in electrical loops, but in a radial configuration between the various electronic equipment locations.

- c. The single ground bus is then connected to the building electrical service equipment ground. This grounding arrangement thus provides only a single path to ground for any circulating ground currents, which will minimize electromagnetic interference with sensitive electronic equipment.
 2. Equipment Requiring Isolated Grounding: Equipment typically grounded to the isolated single point grounding system includes communications and coaxial cable shields, telephone termination block earth grounds, radio transmitter chassis grounds, and electronic equipment signal grounds which are isolated from the equipment chassis.
 3. Grounding Busbars:
 - a. Install a local isolated ground busbar in each room or area where indicated on the Drawings. Ground all sensitive electronic equipment in the room or area to the local isolated ground bus.
 4. Grounding Conductors:
 - a. Conductors from individual equipment and cable shields shall be a minimum No. 6 AWG, type THW stranded copper with green insulation. The conductor from each local isolated ground bus to the service ground bus shall be a minimum of No. 6 AWG, or as indicated on the Drawings, type THW stranded copper with green insulation. Grounding cable with aluminum conductors is not acceptable. Leave 10 feet slack grounding conductor at each Telecommunications Room.
 - b. Conductors shall be routed to provide the minimum possible number of cable bends. The radius of any cable bend shall be not less than 8 inches, and the included angle of any bend shall be a minimum of 90 degrees.
 - c. The grounding conductor MUST NOT be attached to building steel (except as allowed at the main electrical service entrance).
 5. Grounding Connections:
 - a. Connections from individual equipment and cable shields shall use crimp-type connectors of copper or tinned copper construction. Individual equipment connections to local isolated ground buses shall use copper alloy or bronze machine bolts and lock washers.
 - b. Paint-piercing grounding washers shall be used.
 - c. Connectors utilizing aluminum or steel alloys are not acceptable.
 6. Connections to Isolated Grounding Systems: Use insulated equipment grounding conductor and connect only to service grounding electrode. Where isolated grounding system is associated with a separately derived system, bond isolated grounding conductor to system neutral at source of separately derived system in accordance with NEC.
- B. General:
1. Route ground conductors to provide the shortest, most direct path from point to point. Telecommunications ground must be bonded to the lightning protection system grounding and may need additional bonding depending on: spacing, building dimensions, and construction.
 2. Bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit with a conductor sized as a No. 6 AWG, minimum (this makes the conduit a parallel path with the cable). The connections

of the bonding conductors for telecommunications shall utilize listed two-hole compression lugs.

3. A continuous ground path shall be provided in all telecommunications raceways. Grounded cable trays shall be considered continuous ground path.
4. Any grounding or bonding conductor that is run through a metallic conduit shall be bonded to the conduit.
5. Telecommunications primary protector grounding conductor shall be bonded to the ground bus in the room. A minimum of 1 foot separation shall be maintained between this insulated conductor and any DC power cables, switchboard cables, or high frequency cables, even when placed in metal raceway.
6. In buildings where the backbone telecommunications cabling incorporates a shield or metallic member, this shield or metallic member shall be bonded to the ground bus in the room where the cables are terminated or where pairs are broken out.

3.6 CORROSION INHIBITORS

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.7 WIREWAY GROUNDING

- A. Grounding and Bonding Metallic Wireway Systems:
 1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
 2. Install insulated 6 AWG bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 50 feet.
 3. Use insulated 6 AWG bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.

3.8 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 10 feet in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.9 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Engineer has the option to observe below-grade connections prior to backfilling. The Contractor shall notify the Engineer 24 hours before the connections are ready for observation.

3.10 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 26 05 29 HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following hangers and supports indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment included in this Section
 - 1. Conduit and equipment supports
 - 2. Straps
 - 3. Clamps
 - 4. Steel channel, etc.
 - 5. Fastening hardware for supporting electrical work.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Shop Drawings: Show support details if different from methods specified or shown on the drawings.
- B. Product Data: Catalog sheets, specifications and installation instructions.

1.4 QUALITY ASSURANCE

- A. Support systems shall be adequate for the weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 ANCHORING DEVICES

- A. Sleeve Anchors
 - 1. Molly/Emhart's Parasleeve Series
 - 2. Phillips' Red Head Dynabolt Series
 - 3. Ramset's Dynabolt Series

- B. Wedge Anchors
 - 1. Hilti's Kwik Bolt Series
 - 2. Molly/Emhart's Parabolt Series
 - 3. Phillips' Red Head Trubolt
 - 4. Ramset's Trubolt Series
- C. Concrete Screw Anchors
 - 1. Phillips' Red Head Tapcon
- D. Non-Drilling Anchors
 - 1. Hilti's Drop-In Anchor Series
 - 2. Phillips' Red Head Multi-Set II Series
 - 3. Ramset's Dynaset Series
- E. Stud Anchors
 - 1. Phillips' Red Head JS Series

2.2 CAST-IN-PLACE CONCRETE INSERTS

- A. Continuous Slotted Type Concrete Insert, Galvanized:
 - 1. Load Rating 1300 lbs./ft.: Kindorf's D-986
 - 2. Load Rating 2400 lbs./ft.: Kindorf's D-980
 - 3. Load Rating 3000 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-H
 - 4. Load Rating 4500 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-HD
- B. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded.
- C. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept bolts having special wedge shaped heads.

2.3 HAMMER SET ANCHOR

- A. Zinc plated steel drive pin with expanding alloy body:
 - 1. Phillips' Red Head HS Series
 - 2. Hilti HIT Series
 - 3. Ramset Shuredrive Series

2.4 MISCELLANEOUS FASTENERS

- A. Except where shown otherwise on the Drawings, furnish fastener type, size, and grade required for proper installation of the Work. Select from the following:
1. Cadmium or Zinc Coated Fasteners: Dry locations.
 2. Galvanized Fasteners: For exterior use, or for items anchored to exterior walls, except where stainless steel is indicated.
 3. Stainless Steel Fasteners: Type 302 for interior Work; Type 316 for exterior Work; Phillips head screws and bolts for exposed Work unless otherwise specified.

2.5 HANGER RODS

- A. Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with nuts as required to position and lock rod in place. Unless galvanized or cadmium plated, provide a shop coat of red lead or zinc chromate primer paint.
- B. Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger, and 1/4" for single conduits 1" and smaller.

2.6 "C" BEAM CLAMPS

- A. With Conduit Hangers
1. For 1 Inch Conduit Maximum:
 - a. B-Line Systems Inc.'s BG-8, BP-8 Series
 - b. Caddy/Erco Products Inc.'s BC-8P and BC-8PSM Series
 - c. GB Electrical Inc.'s HIT 110-412 Series
 2. For 3 Inch Conduit Maximum:
 - a. Appleton Electric Co.'s BH-500 Series beam clamp with H50W/B Series hangers
 - b. Kindorf's 500 Series beam clamp with 6HO-B Series hanger
 - c. OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWB Series hanger
 3. For 4 Inch Conduit Maximum:
 - a. Kindorf's E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger
 - b. Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger
- B. For Hanger Rods
1. For 1/4 Inch Hanger Rods:
 - a. B-Line Systems Inc.'s BC
 - b. Caddy/Erco Products Inc.'s BC
 - c. GB Electrical Inc.'s HIT 110
 - d. Kindorf's 500, 510
 - e. Unistrut Corp.'s P1648S, P2398S, P2675, P2676

2. For 3/8 Inch Hanger Rods:
 - a. Caddy/Erco Products Inc.'s BC
 - b. Kindorf's 231-3/8, 502
 - c. Unistrut Corp.'s P1649AS, P2401S, P2675, P2676
3. For 1/2 Inch Rods:
 - a. Appleton Electric Co. BH-500 Series
 - b. Kindorf's 500 Series, 231-1/2
 - c. OZ/Gedney Co.'s IS-500 Series
 - d. Unistrut Corp.'s P1650AS, P2403S, P2676
4. For 5/8 Inch Rods: Unistrut Corp.'s P1651AS beam clamp and P1656A Series anchor clip.
5. For 3/4 Inch Rods: Unistrut Corp.'s P1653S beam clamp and P1656A Series anchor clip.

2.7 CHANNEL SUPPORT SYSTEM

- A. Channel Material: 12 gauge steel.
- B. Finishes
 1. Phosphate and baked green enamel/epoxy.
 2. Pre-galvanized.
 3. Electro-galvanized.
 4. Hot dipped galvanized.
 5. Polyvinyl chloride (PVC), minimum 15 mils thick.
- C. Fittings: Same material and finish as channel.
- D. UL Listed Systems
 1. B-Line Systems Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches).
 2. Grinell Corp.'s Allied Power-Strut PS 200 (1-5/8 x 1-5/8 inches), PS 150 (1-5/8 x 2-7/16 inches), PS 100 (1-5/8 x 3-1/4 inches).
 3. Kindorf's B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches).
 4. Unistrut Corp.'s P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5000 (1-5/8 x 3-1/4 inches).
 5. Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches).

2.8 MISCELLANEOUS FITTINGS

- A. Side Beam Brackets
 - 1. B-Line Systems Inc.'s B102, B103, B371-2
 - 2. Kindorf's B-915
 - 3. Versabar Corp.'s VF-2305, VF-2507
- B. Pipe Straps (Heavy Duty Type):
 - 1. Two (2) Hole Steel Conduit Straps:
 - a. B-Line Systems Inc.'s B-2100 Series
 - b. Kindorf's C-144 Series
 - c. Unistrut Corp.'s P-2558 Series
 - 2. One (1) Hole Malleable Iron Clamps:
 - a. Kindorf's HS-400 Series
 - b. OZ/ Gedney Co.'s 14-G Series, 15-G Series (EMT)
- C. Deck Clamps: Caddy/Erico Products Inc.
- D. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where specific fasteners are not specified or indicated for securing items to in-place construction, provide appropriate type, size, and number of fasteners for a secure, rigid installation.
- B. Install anchoring devices and other fasteners in accordance with manufacturer's printed instructions.
- C. Make attachments to structural steel wherever possible.

3.2 FASTENER SCHEDULE

- A. Material
 - 1. Use cadmium or zinc coated anchors and fasteners in dry locations.
 - 2. Use hot dipped galvanized or stainless steel anchors and fasteners in damp and wet locations.
 - 3. For corrosive atmospheres or other extreme environmental conditions, use fasteners made of materials suitable for the conditions.

B. Types and Use: Unless otherwise specified or indicated use:

1. Cast-in-place concrete inserts in fresh concrete construction for direct pull-out loads such as shelf angles or fabricated metal items and supports attached to concrete slab ceilings.
2. Anchoring devices to fasten items to solid masonry and concrete when the anchor is not subjected to pull out loads, or vibration in shear loads.
3. Toggle bolts to fasten items to hollow masonry and stud partitions.
4. Metallic fasteners installed with electrically operated or powder driven tools for approved applications, except:
 - a. Do not use powder driven drive pins or expansion nails.
 - b. Do not attach powder driven or welded studs to structural steel less than 3/16 inch thick.
 - c. Do not support a load, in excess of 250 lbs from any single welded or powder driven stud.
 - d. Do not use powder driven fasteners in precast concrete
5. Metallic hammer set anchors may be used in wall and ceiling applications. Maximum conduit size supported with hammer set anchors is 1 Inch.

3.3 ATTACHMENT SCHEDULE

A. General: Make attachments to structural steel or steel bar joists wherever possible. Provide intermediate structural steel members where required by support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.

1. Make attachments to steel bar joists at panel points of joists.
2. Do not drill holes in main structural steel members.
3. Use "C" beam clamps for attachment to steel beams.

B. Where it is not possible to make attachments to structural steel or steel bar joists, use the following methods of attachment to suit type of construction unless otherwise specified or indicated on the drawings.

1. Attachment to Cast-In-Place Concrete:
 - a. Fresh Concrete: Use cast-in-place concrete inserts.
 - b. Existing Concrete: Use anchoring devices.
2. Attachment to Wood Construction: Use side beam brackets fastened to the sides of wood members to make attachments for hangers.
 - a. Under 15 lbs Load: Attach side beam brackets to wood members with two (2) No. 18 x 1-1/2" long wood screws, or two (2) No. 16 x 1-1/2" long drive screws.
 - b. Over 15 lbs Load: Attach side beam brackets to wood members with bolts and nuts or lag bolts. Do not use lag bolts in wooden members having a nominal thickness (beam face) under two (2) inches in size. Install bolts and nuts or lag bolts in the side of wood members at the mid-point of slightly above. Install plain washers under all nuts.
 - 1) 15-30 lb load: 3/8" x 1-3/4" lag bolts or 3/8" diameter bolts.
 - 2) 31-50 lb load: 1/2" x 2" lag bolts or 1/2" diameter bolts.

- 3) Over 50 lb load (to load limit of structure): 5/8" diameter bolts.
 - c. Bottom chord of wood trusses may be utilized as structural support, but method of attachment must be specifically approved.
 - d. Do not make attachments to the diagonal or vertical members of wood trusses.
 - e. Do not make attachments to the nailing strips on top of steel beams.
3. Attachment to Metal Stud Construction: Use supporting fasteners manufactured specifically for the attachment of raceways and boxes to metal stud construction.
- a. Support and attach outlet boxes so that they cannot torque/twist by using one of the following:
 - 1) Bar hanger assembly.
 - 2) Box hanger with far side support.
 - 3) Between stud mounting bracket.

3.4 CONDUIT SUPPORT SCHEDULE

- A. Provide number of supports as required by National Electrical Code. Exception: Maximum support spacing allowed is 4'-0" for conduit sizes 3 inches and larger supported from wood trusses.
- B. Use pipe straps and specified method of attachment where conduit is installed proximate to surface of wood or masonry construction.
 - 1. Use hangers secured to surface with specified method of attachment where conduit is suspended from the surface.
- C. Use "C" beam clamps and hangers where conduit is supported from steel beams.
- D. Use deck clamps and hangers where conduit is supported from steel decking having hanger tabs.
 - 1. Where conduit is supported from steel decking that does not have hanger tabs, use clamps and hangers secured to decking, utilizing specified method of attachment.
- E. Use channel support system supported from structural steel for multiple parallel conduit runs.
- F. Where conduits are installed above ceiling, do not rest conduit directly on runner bars, T-Bars, etc.
 - 1. Conduit Sizes 2-1/2 Inches and Smaller: Support conduit from ceiling supports or from construction above ceiling.
 - 2. Conduit Sizes Over 2-1/2 Inches: Support conduit from concrete deck, beams, joists, or trusses above ceiling.

3.5 LIGHTING FIXTURE SUPPORT SCHEDULE

- A. General: Do not support fixtures from ceilings or ceiling supports unless it is specified or indicated on the drawings to do so.
 - 1. Support fixtures with hanger rods attached to beams, joists, or trusses. Hanger rod diameter, largest standard size that will fit in mounting holes of fixture.

- a. Where approved, channel supports may span and rest upon the lower chord of trusses and be utilized for the support of lighting fixtures.
 - b. Where approved, channel supports may span and be attached to the underside of beams, joists, or trusses and be utilized for the support of lighting fixtures.
2. Use two (2) nuts and two (2) washers on lower end of each hanger rod to hold and adjust fixture (one (1) nut and washer above top of fixture housing, one (1) nut and washer below top of fixture housing).
 - a. Where specified that an adequately supported outlet box is to support a fixture or be utilized as one (1) point of support, support the box so that it may be adjusted to bring the face of the outlet box even with surface of ceiling
- B. Specific Installations Where Fixtures May Be Supported From New Ceilings Being Installed by the General Contractor:
 1. Support recessed mounted fixtures directly from furring members of furred gypsum board ceilings.
 2. Support recessed mounted fixtures directly from the suspension system of suspended acoustical ceilings. Exception: Support each fixture weighing more than 50 pounds independent of the suspended ceiling grid.
 3. Deliver documents that state actual fixture weights and indicate fixture locations to the General Contractor.
- C. Number of Supports for Ceiling Mounted Lighting Fixtures: Provide at least the following number of supports. Provide additional supports when recommended by fixture manufacturer, or shown on the drawings.
 1. Commercial and Industrial LED Fixtures:
 - a. Support individual fixtures less than two (2) feet wide at two (2) points.
 - b. Support continuous row fixtures less than two (2) feet wide at points equal to the number of fixtures plus one (1). Uniformly distribute the points of support over the row of fixtures.
 - c. Support individual fixtures two (2) feet or wider at four (4) corners.
 - d. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.
- D. Number of Supports for Wall Mounted Lighting Fixtures: Provide at least the following number of supports. Provide additional supports when recommended by fixture manufacturer, or shown on the drawings.
 1. Commercial and Industrial LED Fixtures:
 - a. Support individual fixtures two (2) feet long or less at two (2) points.
 - b. Support individual fixtures over two (2) feet long at three (3) points.
 - c. Support continuous row fixtures at points equal to twice the number of fixtures. Uniformly distribute the points of support.
 - d. An adequately supported outlet box may be utilized as one (1) point of support for fixtures weighing less than 50 pounds.

3.6 CHANNEL SUPPORT SYSTEM SCHEDULE

- A. Use channel support system where specified or indicated on the drawings.
- B. Channel supports may be used, as approved, to accommodate mounting of equipment.
- C. Material and Finish:
 - 1. Dry Locations: Use 12 gauge steel channel support system having any one of the specified finishes.
 - 2. Damp Locations: Use 12 gauge steel channel support system having any one of the specified finishes except green epoxy/enamel.
 - 3. Wet locations: Use 12 gauge steel channel support system having hot dipped galvanized, or PVC finish.

END OF SECTION

**SECTION 26 05 33
RACEWAYS AND BOXES**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this section.
- B. Section 260529 – Hangers and Supports.
- C. Section 262726 – Wiring Devices.
- D. Section 262702 – Equipment Wiring.
- E. Section 270000 – Communications Cable and Equipment.

1.3 SUBMITTALS

- A. Surface Raceway System: Submit product data and catalog sheets for all components.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

- A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.2 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized steel, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Conduit: Steel, galvanized tubing.
- B. Fittings:
 - 1. All steel, set screw, concrete tight. No push-on or indenter types permitted.

2. Raintight Fittings:

- a. All steel construction with zinc electroplate finish provides for durable corrosion resistance
- b. Distinct color to provide quick raintight identification
- c. Integral gasketed compression ring secures and seals for reliable installation
- d. Gasket on male threads of box connector seals installation for raintight connection between the box and the connector

C. Conduit Bodies: All steel threaded conduit bodies.

2.4 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: steel, galvanized, spiral strip.

B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in Specification 265113).

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.6 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90° C conductors.

B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.7 HIGH DENSITY POLYETHYLENE

A. Minimum Size: Two (2) inch, unless noted otherwise

B. Acceptable Manufacturers

- 1. Carlon
- 2. Chevron Phillips Chemical Company
- 3. Approved equal

C. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute).

D. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

2.8 HDPE FITTINGS AND CONDUIT BODIES

- A. Directional Bore and Plow Type Installation: Electrofusion or Universal Aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
- B. For all other type of installation: Coupler must provide a watertight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.
- C. E-loc type couplings are not acceptable in any situations.

2.9 CONDUIT SUPPORTS

- A. See Section 260529.

2.10 AUXILIARY GUTTERS (Wireways)

- A. Description: General purpose type wireway without knockouts.
- B. Size: As indicated on Drawings; length as indicated on Drawings.
- C. Cover: Hinged screw applied cover, provide with full gasketing (rain-tight) where required.
- D. Connector: Slip-in construction; hinged screw applied cover.
- E. Fittings: Lay-in type with removable top, bottom, and side; captive screws. Provide with drip shield as required.
- F. Finish: Rust inhibiting primer coat with gray enamel finish.

2.11 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
- C. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.12 PULL AND JUNCTION BOXES

- A. Pull boxes and junction boxes shall be minimum 4 inch square by 2 1/8th inches deep for use with 1 inch conduit and smaller. On conduit systems using 1 1/4 inch conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square.
- B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

- C. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
- D. Sheet metal boxes larger than twenty-four (24) inches in any dimension shall have a hinged cover or a chain installed between box and cover.
- E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- F. Fiberglass or Concrete Handholes:
 - 1. With weatherproof cover of non-skid finish shall be used for underground installations.
 - 2. Size, type, weight rating, and labeling shall be as noted on the drawings.
- G. The use of box extension rings is discouraged. If they must be used only one ring per box is allowed and wiring must extend a minimum of 6" beyond the front edge of the extension ring.
- H. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.
- I. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
- J. Wireways shall not be used in lieu of junction boxes.

2.13 GENERAL

- A. All steel fittings and conduit bodies shall be galvanized.
- B. No cast metal or split-gland type fittings permitted.
- C. Mogul-type condulets larger than two inches (2") not permitted except as approved or detailed.
- D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.
- E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.
- F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4" and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

- B. Size power conductor raceways for conductor type installed. Conduit size shall be 3/4" minimum except all homerun conduits shall be 1", or as specified elsewhere. Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three (3) current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.
- C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.
- D. Arrange conduit to maintain headroom and present a neat appearance.
- E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- F. Maintain minimum six (6) inch clearance between conduit and piping. Maintain twelve (12) inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- J. Support and fasten metal conduit at a maximum of eight (8) feet on center.
- K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.
- L. In general, all conduits shall be concealed except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical, electrical or utility rooms that are not occupied spaces.
- M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- N. For indoor conduits, no continuous conduit run shall exceed 100 feet without a junction box.
- O. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.2 CONDUIT INSTALLATION

- A. Ground and bond conduit under provisions of Section 260526.
- B. Cut conduit square; de-burr cut ends.

- C. Conduit shall not be fastened to the corrugated metal roof deck. Maintain a minimum six (6) inch separation from the roof deck to conduits.
- D. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- E. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.
- F. All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one (1) locknut, or shall use double locknuts (one (1) each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 260526 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.
- G. Install no more than the equivalent of four (4) 90 degree bends between boxes.
- H. Use hydraulic one (1)-shot conduit bender or factory elbows for bends in conduit larger than two (2) inch size unless sweep elbows are required.
- I. Conduit shall be bent according to manufacturers' recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.
- J. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
- K. Provide 1/8 inch nylon pull string in empty conduit, except sleeves and nipples.
- L. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.
- M. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
- N. Where conduit passes between areas of differing temperatures such as into or out of unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
- O. Route conduit through roof openings for piping and ductwork where possible.
- P. Conduit is not permitted within slab topping or under slabs on grade regardless of thickness of slab without review and approval by Engineer.
- Q. Where reviewed and approved by Engineer, PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) or up through a concrete floor.
- R. Identify conduit under provisions of Section 260553.

- S. All conduit installed underground (exterior to building) shall be buried a minimum of 24" below finished grade, whether or not the conduit is concrete encased.
 - 1. All underground conduits shall be installed with "DANGER – BURIED ELECTRICAL CONDUIT" red flagging tape 6-inches above conduit. Tape shall be continuous along the conduit run.
 - 2. Tracer wire shall be installed on all exterior electrical utilities. Trace wire to be fourteen (14) gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors to be 3M DBR, or approved equal, and shall be watertight to provide electrical continuity. Install trace wire in the same trench with the conduit during installation and secure to conduit as required to ensure that the wire remains adjacent to the conduit. Trace wire access points shall in general be no more than 500' apart.
- T. PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturers' recommendations.

3.3 CONDUIT INSTALLATION SCHEDULE

- A. Conduit other than that specified below for specific applications shall not be used.
- B. Underground Installations Within Five Feet of Foundation Wall: Rigid steel conduit.
- C. Underground Installations More than Five Feet From Foundation Wall: Schedule 40 PVC conduit or HDPE conduit.
- D. Directional Boring: HDPE conduit.
- E. Under Slab on Grade Installations: Where reviewed and approved for use by Engineer: Schedule 40 PVC conduit with galvanized rigid metal conduit 90 fitting or sweeps.
- F. Exposed Outdoor Locations: Rigid steel conduit where subject to damage. Schedule 80 PVC for meter riser per Utility Company guidelines.
- G. Concealed in Concrete and Block Walls: Electrical metallic tubing.
- H. Within Concrete Slab: Not permitted or allowed for this project.
- I. Wet Interior Locations: Electrical metallic tubing with raintight fittings
- J. Concealed Dry Interior Locations: Electrical metallic tubing. MC cabling where specifically indicated on the drawings.
- K. Exposed Dry or Damp Interior Locations: Electrical metallic tubing; raintight fittings where specifically indicated on the drawings.
- L. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot, maximum length shall be three feet. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

- M. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" minimum diameter and six (6) foot maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

3.4 AUXILIARY GUTTERS (WIREWAYS) INSTALLATION

- A. Bolt auxiliary gutter to wall using two (2)-piece hangers or steel channels fastened to the wall or in self-supporting structure.
- B. Mount rain-tight gutter in horizontal position only.
- C. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 260526.

3.5 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
- D. Boxes shall not be fastened to the metal roof deck. Maintain a minimum six (6) inch separation from the roof deck to boxes.
- E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
- F. In case of any question over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
- G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
- H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch by 24 inch access doors.
- I. Locate and install to maintain headroom and to present a neat appearance.
- J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.
- K. Install boxes to preserve room acoustic ratings using approved material and methods.
- L. Boxes mounted in common walls of adjacent rooms shall be offset by at least one stud space to minimize sound transference between rooms. If space does not allow for offsetting of boxes for adjacent rooms by one stud cavity, sound dampening material such as sound batting shall be installed around and between boxes.

3.6 OUTLET BOX INSTALLATION

- A. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. The front edge of the box, plaster ring, extension ring, or listed extender shall not be set back of the finished wall surface more than $\frac{1}{4}$ " in accordance with NEC 314.20. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- B. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.
- C. Power
 - 1. Recessed ($\frac{1}{4}$ " maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4-inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
- D. Low Voltage
 - 1. Recessed ($\frac{1}{4}$ " maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4- $\frac{11}{16}$ " square, 2- $\frac{1}{8}$ " deep. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
- E. Provide knockout closures for unused openings.
- F. Support boxes independently of conduit except for cast boxes that are connected to two (2) rigid metal conduits, both supported within twelve (12) inches of box.
- G. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.
- H. Install boxes in walls without damaging wall insulation.
- I. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- J. Ceiling outlets shall be four (4) inch square, minimum 2- $\frac{1}{8}$ inch deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.
- K. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.
- N. Surface wall outlets shall be four (4) inch square with raised covers for one (1) and two (2) gang requirements. For three (3) gang or larger requirements, use gang boxes with non-overlapping covers.

3.7 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
- B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 26 05 53 IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the labeling of power, lighting, general wiring, signal, fire alarm, and cabling.

1.2 REFERENCES

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Section 260519 – Low Voltage Electrical Power Conductors and Cables
- C. Section 260523 – Control Cables
- D. Section 271010 – Telecommunication Cabling Systems

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: Back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.
- B. Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.
- C. Nameplates: Engraved three-layer laminated plastic, white letters on a black background. Emergency system (Level 1 and Level 2) shall use white letters on red background.
- D. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.
- E. Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16" and smaller junction boxes, fire alarm and control devices.

PART 3 - EXECUTION

3.1 GENERAL

- A. All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.
- B. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.
- C. Install all labels firmly as recommended by the label manufacturer.
- D. Labels shall be installed plumb and neatly on all equipment.
- E. Install nameplates parallel to equipment lines.
- F. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.
- G. Embossed tape will not be permitted for any application.

3.2 JUNCTION AND PULLBOX IDENTIFICATION

- A. The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Blue
Video Surveillance System/MATV	Yellow

- B. Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

3.3 POWER AND CONTROL WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
- B. All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.4 WIRING DEVICE IDENTIFICATION

- A. Wall switches, line voltage wall dimmers, motor switches, receptacles (interior, exterior, floor boxes, etc.), photocells and time clocks shall be identified with circuit numbers and source.

Labeling shall be permanent and machine generated. Label shall have 1/4" black text on a clear label. Label shall be installed at consistent location on the face of the device cover plate.

- B. Wall switches, line voltage wall dimmers, motor switches, receptacles (interior, exterior, floor boxes, etc.), photocells and time clocks shall be identified with circuit numbers and source. Labeling shall be permanent and machine generated (1/4" black text on a clear label) or neatly hand-written permanent marker. Label shall be installed on the inside of the device cover plate.

3.5 NAMEPLATE ENGRAVING

- A. Provide nameplates of minimum letter height as scheduled below.
- B. Panelboards, Switchboards and Load Centers: 1 inch; identify equipment designation. 1/2 inch; identify voltage rating, source and room location of the source.
- C. Equipment Enclosures: 1 inch; identify equipment designation. 1/2 inch; identify voltage rating, source and room location of the source where applicable.
- D. Circuit Breakers, Switches, and Motor Starters/VFD's in Panelboards or Switchboards or Motor Control Centers: 1/2 inch; identify circuit and load served, including location.
- E. Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, Motor Starters, and VFD's: 1/2 inch; identify source and load served.
- F. Junction boxes: 1 inch; identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

3.6 PANELBOARD DIRECTORIES

- A. Typed directories for panels must be covered with clear plastic. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

3.7 ARC FLASH LABELS

- A. Install ARC FLASH WARNING signs on all switchboards, panelboards, and motor control centers.

END OF SECTION

SECTION 26 09 43
DIGITAL LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all work required to provide and install the lighting control components, conductors, cabling and raceways to form a distributed-type digital lighting control system. The lighting control system shall provide time-based, sensor-based (occupancy and/or daylight) and manual lighting controls, as indicated on plans and schedules.
- B. Section includes:
 - 1. Zone controllers
 - 2. Manual controls
 - 3. Digital occupancy sensors
 - 4. Digital photo sensors
 - 5. Programming tools
 - 6. Accessories
 - 7. Wiring

1.2 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.
- B. Specification 260923 Lighting Control Devices
- C. Specification 260519 Low-Voltage Electrical Power Conductors and Cables
- D. Specification 260523 Control Cables
- E. Refer to Digital Lighting Controls Schedule, Digital Lighting Controls - Zone Control Schedule and Digital Lighting Controls - Switch Schedule on plans.

1.3 SUBMITTALS

- A. Product data: Provide a detailed cut sheet with model number(s) and included options clearly noted for each system component type, except cabling. Indicate dimensions.

B. Shop drawings:

1. CAD drawings:

- a. Selected manufacturer shall request CAD floor plans from the Engineer and layout all system devices on the CAD plan, except for cabling. A legend shall be provided on the CAD plan to aid in quick identification of each device and function of that device.
- b. For occupancy and photo sensors: Selected manufacturer shall review ceiling heights, room obstructions (e.g. ceiling fans) and room finishes shown on the architectural plans. Where a conflict arises between the design on plan and selected manufacturer's recommendations, the manufacturer's recommendation shall dictate the type and quantity of devices used in that space.
- c. The locations and quantities of occupancy and photo sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with those sensors. The Contractor shall include in their bid the additional occupancy sensors needed to properly and completely cover the respective room.

2. One-line block diagram: Project specific with nomenclature matching plans. Show interconnections between components specified in this section and necessary system interfaces. Indicate required communication cabling types.

3. Wiring diagrams: Power, signal, and control wiring. Coordinate nomenclature with block diagram.

4. Custom button labels: Submit a custom button label form for each manual switch requiring custom labels.

C. Warranties: Submit sample warranty letter meeting requirements specified in this section.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit under requirement and format listed in Specification 260500 Common Work Results

B. Include the following additional documentation:

1. Copy of on-site system startup reports.
2. All required submittals for this section, updated to reflect required changes from review comments.
3. System device addresses and programmed settings (e.g. an occupancy sensor time delay).
4. Mark locations of zone controllers and interfaces on the as-built drawings.
5. Warranty letter(s) indicating dates of coverage and warranty claim contact information.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Digital lighting control system components shall be sourced from a single manufacturer.
 - 1. Exception: Occupancy sensors and emergency relay devices, tested with and approved by the manufacturer of the selected digital lighting control system, may be from different manufacturer. However, all occupancy sensors (digital and analog) must be from the same manufacturer.
- B. 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.

1.6 DEFINITIONS

- A. BAS: Building automation system.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- C. RS-232: A serial network protocol complying with TIA/EIA-232.

1.7 PLAN NOTATION

- A. Luminaire zoning notation on plans:
 - 1. Basic room zoning
 - a. Rooms with Digital Lighting Control Devices ('L' subscript), but without luminaire subscripts indicates that room contains either one zone of dimmed control or two or fewer zones of switched control. The luminaire subscripts have been omitted to maintain drawing clarity.
- B. Manual controls
 - 1. Basic rooms: Switch breaks and line work shown on plans will identify control within the room.
- C. Digital occupancy sensors
 - 1. Digital occupancy sensors intended to be part of the digital lighting control system will have an 'L' subscript on plan.
 - 2. Basic rooms: All the luminaires in the room shall be controlled by the occupancy sensor(s) shown in that room. Subscripts indicating zones controlled have been omitted from the occupancy sensor.
- D. Digital photo sensors
 - 1. Digital photo sensors intended to be part of the digital lighting control system will have an 'L__' subscript on plan. A ';' is used between groups of zones on plan to indicate

multiple, separate zones are controlled using the input from this one device (e.g. 'a1-a4; a5).

2. Basic rooms: When a photo sensor is shown in a room containing luminaires without subscripts, all the luminaires in the room shall be controlled (i.e. switched or dimmed) by the photo sensor shown in that room as a common group. Subscripts indicating zones controlled have been omitted from the occupancy sensor.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect under provisions of Specification 260500 General Work Results.

1.9 WARRANTY

- A. All equipment shall be warranted to be free of defects in materials and workmanship by the manufacturer for the period of five (5) years from the date of successful system startup.

PART 1 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to Digital Lighting Control Schedule on plan.

2.2 ZONE CONTROLLERS

- A. Controls one or more luminaires in one or more independent lighting control zones. Contains one or more 20-amp, 120/277 volt relays in a plenum rated enclosure suitable for mounting to a junction box or luminaire. Also serves as a connection point for system peripheral devices (e.g. digital occupancy sensors, digital photo sensor, manual controls) serving room.
- B. Provide a zone controller with 0-10 VDC dimming when load(s) controlled are dimmable. Zone controllers ARE NOT shown on plans. Selected manufacturer shall provide in quantities as needed to meet zoning requirements shown on plans and schedules.

2.3 MANUAL CONTROLS

- A. Low voltage manual switches
 1. Field-programmable, momentary-contact, plastic push buttons or rocker switches with LED light for each button indicating status. Provide remote interface and remote power supply, if necessary, for proper switch operation.
 2. Multiple switches shall be ganged together, if needed, to provide control indicated on plans at each manual control location.
 3. Non-\$_{LV} switches: Standard "ON", "OFF", "RAISE" or "▲", and "LOWER" or "▼" labels are acceptable. Custom button labels are not required.

4. \$_{LV} switches: Provide custom button labels as indicated on Digital Lighting Control System – Switch Schedule on plan.
 5. Device color shall be gray with cover plate to match Specification 262726 Wiring Devices
- B. Refer to Digital Lighting Controls – Switch Schedule for button quantity, purpose and lighting zones controlled by each manual control.

2.5 DIGITAL OCCUPANCY SENSORS

- A. Device shall be designed for use with the digital lighting control system.
- B. Sensors to be low voltage devices and shall be powered from a zone controller.
- C. Provide with field-programmable time delay.
- D. Provide with an LED as a visual means that motion is being detected during both testing and normal operation.
- E. Provide mounting hardware suitable for specified mounting location.
- F. Refer to Digital Lighting Controls – Switch Schedule and floor plans for additional information.

2.6 DIGITAL PHOTO SENSORS

- A. Interior photo sensor: Ceiling mounted digital sensor that provides light level readings directly to the zone controller for automatic daylight harvesting. Powered by and connected to the zone controller.
- B. Exterior photocell: Analog photo sensing device specifically designed for exterior use and connected to the system via a suitable interface module. Photocell to have weatherproof housing with visor for shading and lens protection. Adjustable light level sensitivity.
- C. Refer to Digital Lighting Controls – Switch Schedule and floor plans for additional information.

2.7 PROGRAMMING TOOLS

- A. Wireless configuration tool: Handheld device with LCD that allows for configuration of all system devices, one at a time, via device infrared transceivers.
- B. Programming tool IS NOT shown on plans. Furnish programming tool above for system programming.

2.8 ACCESSORIES

- B. Digital I/O interface: Two (2) input and one (1) 24 VDC, 1 amp isolated SPDT relay with N.O. and N.C. output for integration with third-party devices, such as input from a BAS time clock or output to a piece of HVAC equipment via BAS (e.g. turn up HVAC equipment when occupancy sensor senses occupancy). Digital I/O interfaces ARE shown on plans. Isolated output relay: 24 VDC, 1 amp isolated SPDT relay with N.O. and N.C. output only for control of third-party HVAC equipment. Output relays ARE shown on plans.

- D. Analog occupancy sensor interface: Allows for third-party and analog occupancy sensors to be connected into the digital lighting control system. Analog interfaces ARE NOT shown on plans.
- E. Emergency lighting control devices: Refer to Specification 265200 Emergency Lighting for requirements.

2.9 WIRING

- A. Line-voltage conductors: Comply with Specification 260519 Low-Voltage Electrical Power Conductors and Cables.
- B. Digital lighting control system cables: Comply with selected digital lighting control manufacturer's recommendations. All low voltage communication cabling shall be plenum rated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Zone controllers
 - 1. Rooms with accessible ceiling (e.g. lay-in grid): Install zone controller for each room above accessible ceiling directly above a manual control location. Mark location of zone controller on as-built drawing.
 - 2. Rooms with open ceilings: Install zone controller in adjacent room with accessible ceiling. Mark location of zone controller on as-built drawing.
 - a. Exception: Zone controllers for back-of-house rooms (e.g. storage room) with open ceilings may be installed exposed on wall near bottom of structure and above manual control location.
 - 3. Rooms with inaccessible (e.g. gypsum) ceilings: Install zone controller in adjacent room with accessible ceiling or adjacent back-of-house room with open ceiling. Mark location of zone controller on as-built drawing.
- B. Manual Controls
 - 1. Install low voltage wall stations at locations shown on plans. All cabling shall be per manufacturer's recommendation. Connect to zone controller.
 - 2. Program each button function per Digital Lighting Control System – Switch Schedule on plans.
 - 3. Install custom button labels for \$_{LV} wall stations and suitable cover plates for all manual controls.
- C. Digital Occupancy Sensors
 - 1. Connect to zone controller per manufacturer's recommendation.
 - 2. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of

controlled areas per the manufacturer's recommendations. Rooms shall have 90% - 100% coverage (minor motion in office environments).

3. Ceiling sensors shall not be installed within four (4) feet of HVAC air diffusers or heating blowers.
4. Provide a minimum 6' service loop in the cable at the ceiling sensor location to allow for sensor relocation if necessary.

D. Digital Photo Sensors

1. Install the photo sensor at the location recommended by the manufacturer and connect to the system per manufacturer's recommendations utilizing any necessary interface.
2. Daylight harvesting shall begin only after the target foot-candle level(s) in the room has been reached. Light levels for initiating daylight harvesting of each zone shall be field programmed by the factory authorized representative during the start-up process.
3. Aim exterior photo cell north.

E. Accessories

1. Isolated output relay: Install device above accessible ceiling in rooms shown on plan. Wiring to device output and programming of third-party system (e.g. BAS system) by others.
2. Analog occupancy sensor interface: Install device above accessible ceiling in rooms with analog occupancy sensors. Quantity of interfaces needed determined by selected manufacturer based on lighting control requirements for the room.
3. Emergency lighting control devices: Override all dimming of life safety luminaires shown on plan that are part of the digital lighting control system upon normal power loss using UL924 listed device. Provide devices in quantities as needed.

3.2 WIRING INSTALLATION

- A. Install all low voltage cabling in raceways.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions. Provide a physical barrier between

3.3 PRE-INSTALLATION MEETING

- A. A factory-authorized technician from the selected system manufacturer shall meet with the electrical contractor on-site prior to installation of the system to step through the installation process, important installation requirements and answer contractor questions.

3.4 SYSTEM START-UP

- A. Upon completion of the installation by the contractor, the installation of the devices shall be reviewed on-site by the manufacturer's factory authorized technician. This visit may be combined

with the occupancy sensor startup and training visit. The owner shall be included in determining the initial programming of time sweeps and similar functions.

- B. The Electrical Contractor shall provide both the manufacturer and the Electrical Engineer with 10 working days written notice of the scheduled start-up date.
- C. Factory-authorized technician shall utilize the wireless configuration tool to program each digital lighting control system device per plans and owner input.
- D. Factory-authorized technician shall setup the web-based software provided with the digital lighting control system to fit the project and then program each system device per plans and owner input.

3.5 OWNER TRAINING

- A. After system start-up, the factory-authorized technician shall train the owner's representatives in the system architecture, components, programming and any necessary maintenance for the system. This training may take place during the system start-up trip. Operations and maintenance manuals shall be delivered to the owner prior to the owner training being scheduled.

3.6 ADJUSTING

- A. When requested within six (6) months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide one (1) visit to Project during other than normal occupancy hours for this purpose.

END OF SECTION

SECTION 26 2419
LIGHTING AND APPLIANCE BRANCH CIRCUIT LOAD CENTERS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the load center indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 SERVICE ENTRANCE LABEL

- A. Load centers identified for use as service equipment are to be labeled for this application.

1.3 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.
- B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
- C. NEMA PB 1 - Panelboards
- D. NEMA PB 1.1 - General Instruction For Safe Installation, Operation And Maintenance Of Panelboards Rated
- E. 600 Volts Or Less
- F. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.
- G. Federal Specifications W-C-375B - Molded Case Circuit Breakers
- H. Federal Specifications W-P115C - Type 1 Class 2 Load Center.

1.4 SUBMITTALS

- A. Include outline and support point dimensions, voltage, main bus ampacity, and integrated short circuit ampere rating.
- B. Circuit breaker enumeration (frame, ATE, poles, I.C.): Indicate if circuit breakers are suitable for the panelboards' Fully Rated Equipment Rating, or where acceptable, are series connected devices that have been test verified and listed with UL (include documentation proving the compatibility of the proposed circuit breaker combinations). Circuit breakers do not have to be listed as series connected devices when all of the circuit breaker interrupting ratings are equal to, or greater than, the short circuit rating of the panelboard.
- C. When indicated on the panelboard schedule, a coordinated selective scheme between the main circuit breaker and branch/feeder circuit breakers so that under fault conditions the branch/feeder circuit breaker clears the fault while the main circuit breaker remains closed.

- D. Accessories

1.5 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panelboards in factory-fabricated water-resistant wrapping.
- B. Handle panelboards carefully to avoid damage to material components, enclosure and finish.
- C. Store in a clean, dry space and protected from the weather.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers as shown on plans.

2.2 ENCLOSURES

- A. NEMA PB1: Type as shown on the drawings.
- B. Enclosure shall be fabricated of cold rolled steel for NEMA 1 and galvanized steel or equivalent rust-resistant steel for NEMA 3R.
- C. Indoor Type I enclosures shall have a flush front, with finish to be gray baked enamel.
- D. A directory label shall be provided with circuits identified as indicated on the schedule. Directories will be typed, not hand written.

2.3 INTERIORS

- A. NEMA PB1: Type as shown on the plans.
- B. Bus bar connections to the branch circuit breakers shall be the distributed phase type and shall accept plug-on circuit breakers. 300-400 A load centers shall accept a 150 A maximum bolt-on breaker in addition to plug-on types.
- C. Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended future installation of breakers.
- D. Short Circuit Current Ratings as shown plans.
- E. Circuit breakers shall be plug-on thermal magnetic trip, with an integral crossbar to ensure simultaneous opening of all poles in multi-pole circuit breakers.

- F. Circuit breakers shall have an over center, trip free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication.
- G. Handles shall have ON, OFF, and "Tripped" positions. In addition, trip indication shall include a VISI-TRIP indicator appearing in the window of the circuit breaker case (through 125 amperes).
- H. Circuit breakers shall be UL Listed in accordance with UL standard 489 with current ratings as noted on the plans. Interrupting ratings shall be selected to provide the required load center short circuit current rating. Circuit breakers shall be 125 VDC/240 AC rated for nominal 120/240V panels. Minimum interrupting ratings shall be 10,000 amperes for 120/240V circuits, unless higher rating noted on the Contract Documents.
- I. Two- and three-pole circuit breakers 15-60 amperes intended for use with air conditioning, heating, and refrigeration equipment having motor group combinations and marked as such shall have the HACR marking.
- J. Provide UL Class A ground fault interrupter circuit breakers where scheduled on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See specification section 260529 Hangers and Supports.
- B. Install panelboards plumb with wall finishes.
- C. Height: Maximum 6 ft to top.
- D. On surface mounted panels, install a 6" by 6" wireway the width of the panel tub 6" above the top of the panel, parallel to the tub. Install end caps on the wireway. Install four (4) 2" conduits, with bushings, between the panel tub and the wireway. Homerun conduits shall be terminated at the wireway. Wireway shall have a hinged cover with screw fasteners. The wireway aids in the installation of new branch circuits to the existing panel by allowing new conduit to be installed at the wireway, instead of the panel, where there is no exposed live parts.
- E. Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.
- F. Provide filler plates for unused spaces in panelboards.
- G. See specification section 260553 Identification. Provide typed circuit directory for each branch circuit panelboard. Circuit labels shall indicate actual loads served. Use final room numbers and names of equipment. Do not use panel directories used for construction purposes. Revise directory to reflect circuiting changes required to balance phase loads.
- H. Stub five (5) empty 1" conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.
- I. Provide ARC flash identification per NFPA 70E.
- J. Keep panel interior clean at all times.
- K. Cabinet exteriors shall be maintained free of mud, spray-on insulation, paint spray and all substances not placed on the exterior surface by the panelboard manufacturer.

- L. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- M. Panel cabinets shall not be used as raceways or pull boxes for adjacent equipment. Panel cabinets shall not contain wire splices. Panel wiring shall be installed in a neat and workmanlike manner with wire conforming to the contours of the cabinet. Wire bundles shall be wire tied and installed in a manner to protect wire insulation from cover screws and other sharp edges. All phase conductors shall be labeled with a circuit number, readily visible to the panelboard front without removing the dead front cover. All neutral conductors shall be labeled with the circuit number, which they are associated with, within three inches of their termination point
- N. Where new panels are to be installed in existing backboxes, backboxes shall have rust and scale removed from inside. Paint inside of backboxes with rust preventive paint before the new panel interior is installed. Provide new trim and doors for these panels. Covers shall fit tight to the box with no gaps between the cover and the box.

3.2 FIELD QUALITY CONTROL

- A. The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

END OF SECTION

SECTION 26 27 02 EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the electrical connections indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment included in this Section may be specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:
 - 1. HVAC motors, VFDs, and panels
 - 2. Plumbing motors, VFDs, and panels

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.
- B. Section 260533 Raceway and Boxes for Electrical Systems.
- C. Section 260519 Low-Voltage Electrical Power Conductors and Cables.

1.3 SUBMITTALS

- A. Product Data: Provide data for cord and wiring devices.

1.4 COORDINATION

- A. Coordinate all equipment requirements with the various contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.2 OTHER PRODUCTS

- A. Refer to related sections for other product requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Make conduit connections to equipment using flexible PVC-coated metal conduit.
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
- F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.
- G. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.4 HVAC AND PLUMBING CONNECTIONS

- A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.
- B. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches,

solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.

- C. Each motor terminal box shall be connected with a minimum 12", maximum 36" piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
- D. Check for proper rotation of each motor.

3.5 EQUIPMENT CONNECTION SCHEDULE

- A. As indicated on the drawings.

END OF SECTION

**SECTION 26 27 13
ELECTRICITY METERING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the utility metering requirements as well as metering/monitoring equipment for the Owner's use indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual.
- B. Dimensioned plans and sections or elevation layouts (if applicable).
- C. Submit Utility Company prepared drawings (if applicable).

1.4 QUALITY ASSURANCE

- A. 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.

1.5 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
 - 1. Comply with requirements of utilities providing electrical power services.
 - 2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. The following will be furnished by utility company:
 - 1. Meter

2. Primary and secondary service conductors including conduits where required (above and beyond conduit stubs installed by the Contractor).
3. Pole-mounted utility transformer
4. Primary and secondary terminations at the utility transformer.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY ELECTRICAL CONTRACTOR

- A. Meter Socket Base: Comply with requirements of electrical-power utility company.
- B. Meter riser conduit: Schedule 80 PVC from Meter Socket to below grade. Comply with requirements of electrical-power utility company.

2.3 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

- A. Acceptable Manufacturers

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Contact Utility Company and make arrangements to obtain permanent electric service to the Project.
- C. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for primary and secondary cabling, metering leads and extend grounding connections as required by utility company.
- D.

3.2 IDENTIFICATION

- A. Comply with requirements for identification specified in specification section 260553 Identification for Electrical Systems.
 1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
 2. Equipment Identification Labels: Adhesive film labels with clear protective overlay.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections
1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
 2. Turn off circuits supplied by metered feeder and secure them in off condition.
 3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
 4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
- C. Electricity metering will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following wiring devices indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment included in this Section
 - 1. Wall switches
 - 2. Receptacles
 - 3. Device plates and box covers

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

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.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, and shall conform to codes and ordinances of authorities having jurisdiction.
- B. Provide factory fabricated wiring devices in the type and electrical rating for the service indicated. Where type and grade are not indicated provide proper selection to correspond with branch circuit wiring and overcurrent protection.
- C. Attachment of wires to devices shall be by screw pressure under the head of binding screws. Arrangements depending on spring pressure or tension are not acceptable. All binding screws shall be brass or bronze.
- D. See Drawings for Device Schedule.

2.2 DEVICE COLOR

- A. Gary or White, unless noted otherwise. Verify final color selection with Architect.

2.3 WALL SWITCHES

- A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Quiet-type single pole through four (4)-way.
- B. Heavy duty use toggle switch, nylon or high impact resistant face and body, rated 20 amperes and 120/277 volts AC.
- C. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw.
- D. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG.

2.4 STRAIGHT-BLADE RECEPTACLES

- A. Nylon or high impact resistant face, NEMA configuration as scheduled on the Drawings.
- B. Receptacles shall be UL498 Listed and meet Federal Specification WC-596.
- C. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Connector-type receptacles are also acceptable.
- D. Hospital grade receptacles shall be tested and listed according to applicable standards and shall be readily identified on the face of the device by a green dot.

2.5 TWIST LOCK RECEPTACLES

- A. Nylon or high impact resistant face, NEMA configuration as scheduled on the Drawings.
- B. Receptacles shall be UL498 Listed and meet Federal Specification WC-596.
- C. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw.

2.6 GROUND FAULT CIRCUIT INTERRUPTER (GFCI) RECEPTACLES

- A. Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter, auto monitoring (self-test), and line-load reversal function meeting the requirements of UL standard 943 Class A and UL standard 498.
- B. All receptacles installed in outdoor locations, in garages, within six (6) feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.

2.7 TAMPER RESISTANT RECEPTACLES

- A. Tamper resistant receptacles shall be similar to standard receptacles except for the addition of a shutter system that blocks access to the phase and neutral plug slots while the device is not in use.

2.8 SPECIFIC USE RECEPTACLE

- A. Configuration: As indicated on drawings.

2.9 DEVICE PLATES AND BOX COVERS

- A. Cover Plate
 - 1. Finished Spaces: 302/304 smooth stainless steel
 - 2. Unfinished Spaces: 302/304 smooth stainless steel
 - 3. Mechanical and Electrical Rooms: Galvanized
- B. Weatherproof Cover Plate: Gasketed plastic with hinged cover, wet location listed while in use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All dimensions noted are centerline dimensions.
- B. Install wall switches 42 inches above floor, OFF position down.
- C. Install wall dimmers 42 inches above floor; de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.
- D. Install convenience receptacles 18 inches above floor, 4 inches above counters or backsplash, grounding pole on bottom. Mount horizontally where indicated.
- E. Install boxes for information outlets 18 inches above finished floor. Install boxes for telephone jack for wall telephones 48 above finished floor.
- F. Install specific-use receptacles at heights shown on Contract Drawings.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- I. Install devices and wall plates flush and level.
- J. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

3.2 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.3 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

END OF SECTION

SECTION 26 27 28 DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install disconnect switches, fuses and enclosures indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

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.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- A. Fusible Switch Assemblies (use only when overcurrent protection is required): NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class R cartridge type fuses.
- B. Nonfusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Provide auxiliary contacts on fusible switches serving elevator controllers.
- D. Solid neutral bus when neutral conductor is included with circuit.
- E. Provide manufacturer's equipment ground kit in all disconnect switches.
- F. Enclosure: NEMA Type as indicated on Drawings.
- G. Current rating and number of poles as indicated on drawings.

2.2 FUSES

- A. Fuses 600 Amperes and Less: Dual element, time delay, 600 volt, UL Class RK 5. Interrupting Rating: 200,000 rms amperes.
- B. Provide three (3) spares of each size and type fuse. Provide enclosure for spare fuse.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on Drawings.
- B. Install switches so that the maximum height above the floor to the center of the operating handle does not exceed 6'-6".
- C. Provide identification as specified in Section 260553.

END OF SECTION

**SECTION 26 28 13
FUSES**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install 250 and 600 volt fuses indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Provide device dimensions, nameplate nomenclature, and electrical ratings.
- B. Submit manufacturer's product data sheets with installation instructions.

1.4 QUALITY ASSURANCE

- A. Listed by Underwriter's Laboratories, Inc., and suitable for specific application.

1.5 EXTRA MATERIALS

- A. Provide three (3) spares of each size and type used on the Project in a keyed lockable fuse cabinet (keyed to Owner's master electrical key).
- B. Fuse cabinet to be mounted in the building as designated by Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 FUSES RATED 600 VOLTS OR LESS

- A. Fuses for Safety Switches (Motor Circuits) and Service Disconnects:
 - 1. Cartridge Type (250 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-5, 200,000 amperes R.M.S. symmetrical interrupting capacity.
 - a. Cooper Industries Inc.'s/Bussman Div. Type FRN-R
 - b. Mersen Type TR-R
 - c. Littlefuse Inc.'s Type FLN-R

2. Cartridge Type (600 Volts, 600 Amperes or Less): Dual element time-delay, UL Class RK-5, 200,000 amperes R.M.S. symmetrical interrupting capacity.
 - a. Cooper Industries Inc.'s/Bussmann Div. Type FRS-R
 - b. Mersen Type TRS-R
 - c. Littlefuse Inc.'s Type FLS-R
 3. Cartridge Type (600 Volts or Less - Above 600 Amperes): Current limiting, UL Class L, 200,000 amperes R.M.S. symmetrical interrupting capacity.
 - a. Cooper Industries Inc.'s/Bussmann Div. Type KTU
 - b. Mersen Type A4BY
 - c. Littlefuse Inc.'s Type KLP-C
- B. Fuses for Safety Switches (Lighting and Heating Circuits):
1. Cartridge Type (250 Volts): Single element, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity.
 - a. Cooper Industries Inc.'s/Bussmann Div., Type KTN-R
 - b. Mersen Type A2K-R
 - c. Littlefuse Inc.'s Type KLN-R
 2. Cartridge Type (600 Volts): Single element, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity.
 - a. Cooper Industries Inc.'s/Bussmann Div. Type KTS-R
 - b. Mersen Type A6K-R
 - c. Littlefuse Inc.'s Type KLS-R

2.3 SPARE FUSE CABINET

- A. Cabinet: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
- B. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
- C. Finish: Manufacturer's standard finish.
- D. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fuses shall not be installed until equipment is ready to be energized.
- B. Install fuse with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse storage enclosure in Electrical Room or where indicated on the Drawings.

END OF SECTION

**SECTION 26 51 13
INTERIOR LIGHTING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the equipment indicated in the Contract Documents with supplementary items necessary for a proper and functioning installation.
- B. Section Includes:
 - 1. Interior luminaires
 - 2. Exit signs

1.2 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.
- B. Refer to Division 26 Section "Low Voltage Electrical Power Conductors and Cables" for wiring requirements
- C. Refer to Division 26 Section "Emergency Lighting" for emergency battery ballasts, emergency lighting units, exit signs with battery backup.
- D. Refer to Division 26 Section "Site Lighting" for site luminaires and poles.

1.3 SUBMITTALS

- A. Product data:
 - 1. For each luminaire type, submit a technical cut sheet with complete model number(s) and included options clearly noted, plus luminaire support points, weight, accessory information and photometric performance data indicating total luminaire efficiency. Place luminaire type (e.g. 'F1') at the top of each cut sheet page for that luminaire.
 - 2. Submit a technical cut sheet for the associated driver proposed for that luminaire. When multiple luminaires use the same driver, a single cut sheet for the driver may be submitted with all luminaires utilizing that driver clearly labeled on the cut sheet.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit under requirements and format listed in Division 26 Section "Common Work Results".

B. Include the following documentation

1. All required submittals for this section, updated to reflect required changes from review comments.
2. Warranty letter(s) indicating dates of coverage and warranty claim contact information.

1.5 QUALITY ASSURANCE

- A. Electrical components 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. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

1.6 DEFINITIONS

- A. CRI: Color rendering index
- B. CCT: Correlated color temperature
- C. BUG: Backlight, Uplight and Glare ratings for luminaires based on IESNA TM-15-07.

1.7 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported from structure, including HVAC equipment, fire-suppression system, and partition assemblies.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver luminaires in factory-fabricated packaging.
- B. Handle lighting fixtures carefully to prevent breakage, denting and scoring the fixture finish. Do not install damaged lighting fixtures.
- C. Store product in a clean, dry space protected from weather.

1.9 WARRANTY

- A. All equipment shall be warranted to be free of defects in materials and workmanship by the manufacturer for the time period listed below from the date of project substantial completion:
 1. LED luminaires (including LED power supply): Five (5) years

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES

- A. Refer to the Luminaire Schedule on the drawings for types of luminaires (e.g. F1, F2, EM1, etc.). The luminaire type listed in the schedule will appear on the lighting plans adjacent to the symbol for each luminaire.
- B. For each luminaire type the manufacturer and model listed first in the schedule, in conjunction with all other luminaire attributes listed on the schedule, shall be considered the basis of design. The remaining acceptable manufacturers shall meet or exceed the performance of the basis of design. When a discrepancy exists between the model number and the other attributes listed for that luminaire, the Contractor shall ask for clarification during the bidding process or include the more expensive option as part of their bid.
- C. Provided luminaire doors with rubber, fiberglass gaskets or equivalent material to prevent light leak. Luminaires shall be provided with proper thermal protection as required for surrounding environment.
- D. Acrylic lenses shall be prismatic and not less than 0.125-inches thick nominal, unless noted otherwise on plans.
- E. All luminaire finishes shall be factory applied unless specifically noted otherwise. Refer to schedule on drawings for finish color.

2.2 SOLID STATE LUMINAIRES

- A. Photometric Measurement: Comply with IESNA LM-80-21.
- B. Lumen Maintenance: Tested in accordance to IESNA LM-79-19.
- C. Long Term Lumen Maintenance: Comply with IESNA TM-21-11.
- D. The basis of design for each LED luminaire is listed on the Luminaire Schedule. All other listed acceptable manufacturers shall meet or exceed the delivered lumens of the basis of design using +/- 10% input watts.
- E. CRI and CCT per Luminaire Schedule on plans

2.3 EXIT SIGNS

- A. Mounting type and chevrons shall be as indicated on the Drawings. Lettering and chevron-type directional indicators shall comply with NFPA 101, Life Safety Code, and shall be Listed in accordance with UL 924, Standard for Safety Emergency Lighting and Power Equipment.
- B. Sign housing type shall be as indicated on the Luminaire Schedule.
- C. Mounting canopies will be of identical construction and color to match the exit frame.

2.4 LED POWER SUPPLIES

- A. Acceptable manufacturers: Selected and tested by luminaire manufacturer with specified luminaire for compatibility and performance.
- B. Provide with 0-10 VDC dimming interface when specified on Luminaire Schedule on plans.
- C. LED power supplies shall have temperature and a moisture rating suitable for the environments for which it is to be installed. Luminaires installed in low ambient temperature areas shall have power supplies specifically designed for low temperature operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install luminaires at locations and heights as indicated, in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA Standards and with recognized industry practices to ensure that luminaires fulfill requirements.
- B. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- C. Check the building electrical system requirements and architectural finishes. Regardless of the catalog number prefixes and suffixes shown, furnish fixtures with the proper trim, frames, supports, hangers, driver, voltage rating, and other miscellaneous appurtenances to properly coordinate with Project conditions. Verify with Engineer prior to ordering.
- D. Check the type of ceilings to be installed in each room and verify that the recessed light fixtures are proper for the type of ceiling to be installed before ordering fixtures. Provide a frame compatible with the type of ceiling in which the recessed lighting fixture is installed. Refer to the Architectural Room Finish Schedule for the specified ceiling type.
- E. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Heavy duty jack chain supports may be used where indicated on the fixture schedule. Provide pendant or chain length required to suspend luminaire at indicated height.
- F. Support luminaires larger than 2 x 4 foot size independent of ceiling framing using #12 steel wires anchored to structure.
- G. Locate ceiling luminaires as indicated on the architectural reflected ceiling plan.
- H. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- I. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Fixture Used With Exposed Raceway):
 - 1. Provide finishing collar where surface mounted fixture is installed on an exposed raceway outlet box and the fixture base is larger than the outlet box.

2. Provide combination finishing collar/outlet box where surface mounted fixture is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into fixture body due to fixture design.
- J. The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.
- K. Install recessed luminaires to permit removal from below.
- L. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- M. Install wall mounted luminaires at height as scheduled.
- N. Install accessories furnished with each luminaire.
- O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- P. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.
- Q. Highbay Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between housing and structure. Provide safety chain between reflector and housing.
- R. Protect installed fixtures from damage during the remainder of the construction period.

3.2 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Aim and adjust luminaires as indicated on Drawings or as directed by the Architect/Engineer.
- C. Touch up luminaire finish at completion of work.

3.3 FIXTURE CONNECTIONS

- A. Direct box or conduit connections for surface and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Flexible metal conduit shall be minimum 3/8" diameter and six foot maximum length. Conduit length shall allow movement of the fixture for maintenance purposes.
- B. The flexible connectors shall be all steel, galvanized, clamp type with locknut or snap-in connector including those used on the master-slave unit.
- C. Fixture whips shall be supported to prevent them from lying on or being supported by the ceiling grid. Supports shall be listed for raceway support. Tape and other temporary means are not acceptable.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of installation of interior lighting fixtures, and after circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at the Project Site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. All existing fixtures in work area that are re-used or relocated shall be cleaned inside and out, broken or damaged parts replaced and new lamps installed.

END OF SECTION

**SECTION 26 52 00
EMERGENCY LIGHTING-UNIT EQUIPMENT**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following emergency lighting-unit equipment indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment included in this Section
 - 1. Emergency lighting units
 - 2. Exit signs
 - 3. Battery back-up ballasts.

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Include outline drawings, lamp and ballast data, battery/charger information, support points, weights, accessory information and performance data for each luminaire type.
- B. For each luminaire type, submit luminaire information in the following example table format, and submit catalog cuts with highlighted catalog numbers and required accessories.

LUMINAIRE		BALLAST	LAMP	ANSI INPUT WATTS
Type	Manufacturer and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	

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 DELIVERY, STORAGE AND HANDLING

- A. Deliver lighting fixtures individually wrapped in factory-fabricated fiberboard type containers.
- B. Handle lighting fixtures carefully to prevent breakage, denting and scoring the fixture finish. Do not install damaged lighting fixtures.

- C. Store product in a clean, dry space protected from weather.

PART 2 - PRODUCTS

2.1 EXIT/EMERGENCY LIGHTING AND ACCESSORIES

- A. See the Luminaire Schedule on the drawings, for type of fixtures and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Fixtures manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated fixtures, and meet the intent of the design.
- B. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 SELF-POWERED EXIT SIGNS

- A. Acceptable Manufacturers: As indicated on the Drawings.
- B. Exit light mounting type shall be as indicated on the Drawings.
- C. Housing material shall be as indicated on the Drawings.
- D. Lettering and chevron-type directional indicators shall comply with NFPA 101, Life Safety Code, and shall be Listed in accordance with UL 924, Standard for Safety Emergency Lighting and Power Equipment.
- E. Exit sign design will allow universal 120/277VAC, 60 Hz operation.
- F. Normal illumination will be provided by LED's. Normal LED lamp life shall be in excess of 20 years.
- G. Mounting canopies will be of identical construction and color to match the exit frame.
- H. Provide with a fully automatic emergency operation module. All emergency module components shall mount inside the exit sign housing and will include a solid-state, constant current type battery charger; a maintenance-free, nickel-cadmium battery; an AC-On indicator light; and a test switch.
- I. Standard operating temperature: 68°F to 86°F. Provide exit sign suitable for environmental conditions above or below the standard operation temperature or as noted in the Luminaire Schedule.
- J. Provide unit with self-testing/self-diagnostic electronics where noted on the Drawings.
- K. Provide wire guard where noted on the Drawings.

2.3 EMERGENCY LIGHTING UNITS

- A. Acceptable Manufacturers: As indicated on the Drawings.
- B. Emergency light mounting shall be as indicated on the Drawings.

- C. Housing material shall be as indicated on the Drawings.
- D. Units shall comply with NFPA 101, Life Safety Code, and shall be Listed in accordance with UL 924, Standard for Safety Emergency Lighting and Power Equipment.
- E. Emergency operation shall be provided for a minimum of ninety (90) minutes.
- F. Design will allow universal 120/277VAC, 60 Hz operation.
- G. Lamp type, quantity, and wattage shall be as indicted on the Drawings.
- H. Emergency components shall include a solid-state, constant current type (for nickel-cadmium batteries) battery charger; a maintenance-free, nickel-cadmium battery; an AC-On indicator light; and a test switch.
- I. Standard operating temperature: 68°F to 86°F. Provide emergency light suitable for environmental conditions above or below the standard operation temperature or as noted in the Luminaire Schedule.
- J. Provide unit with self-testing/self-diagnostic electronics where noted on the Drawings. Self-testing feature shall comply with the requirements of NFPA 101 and the NEC.
- K. Provide wire guard where noted on the Drawings.

2.4 REMOTE LIGHTING HEADS

- A. Acceptable Manufacturers: As indicated on the Drawings.
- B. Remote head mounting shall be as indicated on the Drawings.
- C. Housing material shall be as indicated on the Drawings.
- D. Lamp type, quantity, voltage, and wattage shall be as indicted on the Drawings.
- E. Units shall comply with NFPA 101, Life Safety Code, and shall be Listed in accordance with UL 924, Standard for Safety Emergency Lighting and Power Equipment.

2.5 EMERGENCY BALLASTS

- A. Acceptable Manufacturers
 - 1. Philips Bodine
 - 2. Iota Engineering
- B. LED Lamps
 - 1. Emergency lighting shall be provided by using a standard LED fixture equipped with an emergency driver. The emergency driver shall consist of two (2) field-replaceable, high-temperature, maintenance-free nickel-cadmium batteries with a separate battery charger and electronic circuitry contained in a metal case. Battery and installation hardware shall be provided along with a test switch. The emergency driver shall be capable of operating

an LED load of up to 23.1 Watts at rated current (700 mA) for a minimum of 90 minutes. It is suitable for damp locations as well as sealed and gasketed fixtures. The emergency driver shall comply with emergency standards set forth by the current NEC. The emergency driver shall be UL Component Recognized for factory installation only and shall be warranted for a full three (3) years from date of purchase.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- C. Check the building electrical system requirements and architectural finishes. Regardless of the catalog number prefixes and suffixes shown, furnish fixtures with the proper trim, frames, supports, hangers, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with Project conditions. Verify with Engineer prior to ordering.
- D. Check the type of ceilings to be installed in each room and verify that the recessed light fixtures are proper for the type of ceiling to be installed before ordering fixtures. Provide a frame compatible with the type of ceiling in which the recessed lighting fixture is installed. Refer to the Architectural Room Finish Schedule for the specified ceiling type.
- E. Install suspended luminaires using pendants supported from swivel hangers. Chain or cable supports may be used in unfinished spaces or where indicated on the fixture schedule. Provide pendant, chain, or cable length required to suspend luminaire at indicated height.
- F. Fixture whips shall be supported to prevent them from lying on or being supported by the ceiling grid. Supports shall be listed for raceway support. Tape and other temporary means are not acceptable.
- G. Locate exit and emergency luminaires as indicated on the Drawings. Install accessories furnished with each luminaire.
- H. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- I. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Fixture Used With Exposed Raceway):
 - 1. Provide finishing collar where surface mounted fixture is installed on an exposed raceway outlet box and the fixture base is larger than the outlet box.
 - 2. Provide combination finishing collar/outlet box where surface mounted fixture is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into fixture body due to fixture design.
- J. The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if

required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.

- K. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- L. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.
- M. Protect installed fixtures from damage during the remainder of the construction period.
- N. Insert a copy of the battery warranty in each unit and mark on batteries the date placed in service.
- O. Emergency Lighting Units
 - 1. Units shall be mounted so that they may easily be removed for service.
 - 2. Units shall be permanently connected to a 120/277 volt power source in compliance with the NEC.
 - 3. Remote lamps shall be connected to battery unit using raceway and wire size noted on the Drawings.

3.2 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Aim and adjust luminaires as indicated on Drawings or as directed by the Architect/Engineer.
- C. Touch up luminaire finish at completion of work.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of interior lighting fixtures, and after circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at the Project Site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION

**SECTION 26 56 29
SITE LIGHTING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install site lighting indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. Equipment included in this Section
 - 1. Exterior luminaires and accessories

1.2 REFERENCES

- A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate dimensions and components for each luminaire, pole and base.
- B. Product Data: Provide dimensions, ratings, performance data, lamp and ballast data, weights and accessory information for each type.
- C. Manufacturer's Instructions:
 - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under "Regulatory Requirements".
 - 2. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Light Layout: Provide a computer generated factory point to point foot-candle layout of the project for each area involved.
- E. Design Data: Include lighting calculations.

1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of each luminaire, pole and underground circuit.
- B. Provide record drawings of the final, as installed and measured, point to point foot-candle layout for each area involved.

1.5 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.6 COORDINATION

- A. Use bolt templates and pole mounting accessories to install anchor bolts in pole base.

1.7 EXTRA MATERIAL

- A. Provide five (5) percent of total fuses provided for each size, but not less than one (1) of each size.

1.8 WARRANTY

- A. All equipment shall be warranted to be free of defects in materials and workmanship by the manufacturer for the time period listed below from the date of project substantial completion:
 - 1. LED luminaires (including LED power supply): Five (5) years

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Furnish products as specified in schedule on Drawings.

2.2 LAMPS

- A. Provide lamp type specified for luminaire.
- B. LED: Provide with integral surge protection. See schedule.
- C. All lamps shall be new and by the same manufacturer.

2.3 FUSES

- A. Furnish and install a fuse holder and fuse in each ungrounded leg of the electrical circuit supplying the outdoor luminaire. Every luminaire shall be separately fused with a waterproof fuse holder. Size the fuse for the amperage of the luminaire. Tap the circuit conductors with a minimum #10 AWG conductor to serve the luminaire. The fuse and holder shall be accessible through the handhole. Provide sufficient wire to bring fuse holder outside of handhole.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturers' instructions.
- B. Minimum underground conduit size is 1 inch. Refer to drawings for additional information.
- C. Underground and exterior wire shall be type XHHW-2. Refer to drawings for additional information.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.3 ADJUSTING

- A. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.
- B. All new lamps shall be operational at the Substantial Completion of the project.

3.4 CLEANING

- A. Clean photometric control surfaces.
- B. Clean finishes and touch up damage.

END OF SECTION

SECTION 27 05 13
COMMUNICATIONS COMMON WORK RESULTS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the required remote control and signal cabling indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 SUMMARY

- A. Section includes
 - 1. Contractor Responsibility and Qualifications
 - 2. Reference Standards and Codes
 - 3. Required Contractor Training
 - 4. Quality Assurance
 - 5. Permits, Fees, and Certificates of Approval
 - 6. Submittals
 - 7. Product Assurance
 - 8. Coordination
 - 9. Pre-installation Conference
 - 10. Alternates, Substitution and Change Orders
 - 11. Project Management
 - 12. Delivery and Storage
 - 13. Cleaning

1.3 CONTRACTOR RESPONSIBILITY AND QUALIFICATION

- A. The chosen Communications Contractor (here after referred to as Contractor) shall provide a minimum one (1) year warranty on material, installation and workmanship.
- B. Contractor shall provide all components, materials, services and labor essential for a complete and functional structured cabling system.

- C. The Contractor shall be responsible for complying with all local, state and federal laws and regulations applicable to the work performed, although said law, rule or regulation is not identified herein.
- D. Examination of building and site shall be the responsibility of the Contractor: Contractors shall examine site and building as required prior to installation to determine any conditions affecting the scope of work. Contact Owner representative for arrangements. All systems and cabling are assumed working and in good condition unless contractor documents exceptions.
- E. Contractor shall call for all inspections required. Final payment of this contract will not be made until final inspections have been completed and all deficient items noted have been corrected.
- F. Contractor will respect and protect the privacy and confidentiality of Owner, its employees, processes, products, and intellectual property to extent necessary, consistent with the legal responsibilities of the State of Iowa and Owner policies.
- G. Use of sub-contractors: The Contractor shall inform in writing to Owner's representative and General Contractor about the intention to use sub-contractors and the scope of work for which they are being hired. Owner's representative prior to the sub-contractor's hiring and start of any work must approve the use of sub-contractors in writing.
- H. Contractor will be required to provide a sufficient number of technicians for this project to stay on schedule.
- I. Contractor shall identify the qualifications of their technician. Vendor shall also identify the type(s) of certifications / testing that its technicians go through before and after being hired on by your company.
- J. Contractor must identify plan and as-built documentation processes used by your company, such as AutoCAD, Adobe and Bluebeam.
- K. Installers: Only technicians certified by equipment manufacturer are approved.

1.4 REFERENCE STANDARDS AND CODES

- A. Supervisors and lead installers shall have a working knowledge and understanding of the following documents and codes are their most recent updates, and shall be familiar with the requirements that pertain to this installation. Installers shall be familiar with and have practical working knowledge of the requirements that pertain to this installation.
- B. Codes: Comply with applicable sections of the most recent editions and addenda of following for interior and exterior installations. Ensure you are using the latest and most up to date standards regulations applicable. [NOTE: All installations within non-State owned properties shall comply with all applicable codes and regulations adopted by the authorities having jurisdiction.]
 - 1. International Building Code (IBC)
 - 2. National Electrical Code (NEC/NFPA 70)
 - 3. National Electrical Safety Code (NESC IEEE)

- C. Standards: Comply with applicable sections of the most recent editions and addenda of the following for installations and testing of communications cabling, connectors, and related hardware. Comply with applicable sections of the following for interior and exterior installations.

1. IEEE Std 1100, Recommended Practice for Powering Grounding Sensitive Electronics
2. TIA/EIA-568-B1.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements.
3. TIA/EIA-568-B.2-4, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
4. TIA/EIA-569-A-7, Commercial Building Standard for Telecommunications Pathways and Spaces.
5. ANSI/TIA/EIA-569-A, Commercial Building Standards for Telecommunications Pathways and Spaces.
6. TIA-604-5-C, Intermateability Standard (FOCIS), Type MPO, FOCIS-5
7. TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure.

1.5 ELECTRONIC DOCUMENT RELEASE

- A. Electronic versions of the bid documents will be made available to the contractors for use during the bidding process and to help generate fabrication drawings for various systems. A summary of the requirements for the various document types is listed below:

1. PDF
 - a. Contact the Construction Manager or Architect to obtain a PDF version of the Bid Documents. No Document Release Form is required.
2. REVIT
 - a. The REVIT drawings will be converted to AutoCAD and then transferred to the contractor.
 - b. Bluestone Engineering can provide an AutoCAD version of the bid documents for the contractor to use for generating shop drawings and fabrication drawings. This will include plan drawings with the architectural background. The contractor is responsible for incorporating any modifications that occur during bidding by all disciplines. Details and schedules will not be included.
 - c. A document release form (see attached) will be required to be completed by the contractor to determine the version of AutoCad and drawings required.
 - d. Submittal of the document release form will be required prior to the AutoCAD files being transmitted.

1.6 SUBSTITUTION

- A. All manufacturers listed as Acceptable Manufacturers in each specification section are considered equal to the basis of design. The basis of design is preferred and will take precedence. Any products from an alternate approved manufacturer need to meet the requirements and performance specified and shall be equal to the basis of design.

- B. The Contractor may request permission for a substitution of any item (equipment or material), subject to the following conditions:
1. Submit substitution requests in writing to the Engineer, on a form supplied by the Engineer. A sample copy of this form is included at the end of this section. An electronic copy can also be provided to the Contractor by the Engineer.
 2. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contractor documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed as well as any re-design costs incurred by the Architect or Engineer. The Contractor is also responsible for coordinating changes required by other trades.
 3. Any requests for alternate manufacturers must be submitted to the Architect/Engineer at least ten (10) days prior to bid day. Incomplete substitution requests will not be considered.
- C. Approval
1. No work involving requests for substitution shall commence without written approval on the provided form by the Engineer.
 2. Any work started or material ordered/installed by the Contractor without written approval shall be removed/repared at the sole expense of the Contractor. The Contractor will also be responsible for any costs incurred by the Owner for such rework.

1.7 REQUIRED CONTRACTOR TRAINING

- A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
1. Personnel trained and certified in the design of the Structured Cabling System.
 2. Personnel trained and certified to install the Structured Cabling System.
 3. The Designer and Installer shall show proof of current "Certified Installer" of the Structured Cabling System via an updated certificate given after attending the appropriate training course or an on-line re-certification class.
 4. Provide references for the type of installation provided in this specification.
 5. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and OTDR.
 6. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

1.8 QUALITY ASSURANCE

- A. Perform work in accordance with contract documents and governing codes and standards.

- B. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals).
- C. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.
- D. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.
- E. Component Compliance: The provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.
- F. Pre-installation Inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
 - 1. Test each pair of UTP cable for open and short circuits. Test results to be submitted to Owner.
- G. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 SUBMITTALS

- A. General
 - 1. Bill of materials, noting any long lead time items in business days. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number as indicated in the Contract Documents.
 - 2. Proposed test forms for fiber backbone, copper backbone and horizontal UTP cable.
 - 3. Project schedule including all major work components that materially affect any other work on the project.
 - 4. Basis of Design Certification of Structure Cabling System
 - 5. System Drawings: Project specific system drawing noting systems components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system.

- B. Two (2) indexed sets of manufacturer's technical data for each product including product description, specifications including labeling or listing by an agency acceptable to the Owner, and storage requirements.
- C. Firestop design basis documentation that shall include each type of communication penetration, type of building construction being penetrated including the hourly resistance rating of floor, wall, or other partition of building construction into which firestop design will be installed, and firestop device or system proposed for use.
- D. Installation Procedures and Material Safety Data Sheets shall be included with products delivered to the job site.
- E. Informational Submittals
 - 1. Manufacturer's Installation, Start-Up and Adjustment Instructions.
 - 2. Certificates:
 - a. Certify that field tests have been performed and that work meets or exceeds specified requirements.
 - b. Certify that factory tests have been performed and that work meets or exceeds specified requirements. Certificates may be based on recent or previous test results, provided material or products tested are identical to those proposed for this Project.
 - c. Calibration report of test equipment for fiber and copper. Last calibration date should not be older than one (1) year from the 1st day of testing.
 - 3. Field Test Results: Submit sample cable test results showing report format and parameter test.
 - 4. Operation and Maintenance Data

2.3 PRODUCT ASSURANCE

- A. All materials shall be UL and/or ETL approved and labeled in accordance with NEC for all products where labeling service normally applies.
- B. Materials and equipment requiring UL 94, 149, or 1863 listing shall be so labeled. A modification of products that nullifies UL labels is not permitted.
- C. All materials and equipment provided shall be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacture of such products. All materials shall be typical commercial designs that comply with the requirements specified. All materials and equipment shall be readily available through manufacturers and/or distributors. All equipment shall be supplied complete with any optional items required for proper installation.
- D. Materials or Manufacturers not listed in this Division 27 but are required materials to provide a complete and functioning cable infrastructure system shall have cut sheets and product data included in the material and procedures submittal package.
- E. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility.

- F. Contractor shall test all fiber cable while on the reel prior to installation of the cable. The Contractor shall assume liability for replacement of cable should it be found defective at this time or a later date prior to customer acceptance.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment with Architect or Owner.
 - 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 connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- E. Contractor shall be responsible for coordination with all trades, to include required scheduling of materials and/or equipment with Owner and/or General Contractor for delivery, storage and protection of equipment as required.

3.2 PRE-INSTALLATION CONFERENCE

- A. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc., with consultant and/or project manager/Owner representative.
- B. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.

3.3 FIELD QUALITY CONTROL

- A. The Contractor shall perform the following field inspections during installation and commissioning:
 - 1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings.

2. Visually inspect cabling placements, pathways and terminations in communications equipment rooms, telecommunications rooms and work area's for compliance with standards and codes.
3. Visually inspect grounding and bonding for compliance with standards and codes.
4. Visually inspect all installed cable pathways and wall penetrations for compliance with standards and codes.

3.4 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

- A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.
- B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall response to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.
- C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

3.5 PROJECT MANAGEMENT

- A. Contractor shall designate a project manager to act as the single point of contact. Project manager shall oversee all work performed to ensure a quality installation compliant with specifications as outlined in documents (which includes all specifications and drawings). The General Contractor to review a copy of resume of the on-site Project Manager and each on-site teams.
- B. The Contractor project manager/supervisor shall attend meetings arranged by Owner's representatives, and/or other parties affected by work of this Division 27.
- C. Contractor shall provide written progress reports to Owner's representative and other parties affected by work of this Division 27. This progress report must include:
 1. Update time schedule with estimate time of completion. This must be in MS Project format or equal to software, also showing the time baseline.
 2. Work performed last week.
 3. Work planned for the upcoming week.
 4. Percentage complete of work performed.
 5. Identify potential risks that can impact scope and/or the time schedule.

3.6 DELIVERY AND STORAGE

- A. The Contractor shall assume custody and responsibility for the items upon delivery and determining that the contents are complete and in satisfactory condition for installation.
- B. Delivery, loss, storage and protection: All materials and equipment delivered and placed in storage shall be stored with protection from the weather, humidity, and temperature variation, dirt, and dust, or other contaminants.
- C. Coordinate deliveries and submittals with the General Contractor/Owner to ensure a timely schedule installation.
- D. Contractor shall be responsible for all handling and control of cabling equipment. Contractor is liable for any material loss due to delivery and storage problems.
- E. Coordinate with General Contractor/Owner on location of storage materials.

3.7 AS-BUILTS

- A. Record copy and as-built drawings:
 - 1. Provide record copy drawings periodically throughout the project as requested by the General Contractor or Owner and at end of the project on CD-ROM. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination points. CAD drawings are to incorporate test data imported from the test instruments.
 - 2. The as built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts, rack elevations and frame installation details. The as-builts shall include all field changes made up to construction completion:
 - a. Field directed changes to cross connect and patching schedule.
 - b. Horizontal cable routing changes.
 - c. Backbone cable routing or location changes, inclusive outside plant physical pathways (if within scope of this project).
 - d. Associated detail drawings.

3.8 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.
- B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
- D. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, tiles racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide

professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.9 PROJECT CLOSEOUT REQUIREMENTS

A. Final project closeout tasks

1. Deliver all spare parts listed in each specification section. Deliver to Owner chosen location.
2. All equipment labeled per specifications.
3. All equipment cleaned and ready for use.

B. Contractor Requirements

1. Marked up drawings and specifications provided to Engineer for incorporation of as-built drawings or to serve as the as-built drawings depending on the project requirements. As-built drawings shall be clean and legible.
2. Operation and Maintenance (O&M) Manuals shall include the following:
 - a. Contractor contact for warranty work.
 - b. Approved shop drawings, incorporating all review comments.
 - c. Warranty copies
 - d. Operation and maintenance instructions
 - e. Proposed test forms for fiber/copper backbone and horizontal UTP cables.

C. Two (2) final approved O&M Manuals shall be delivered to Owner. Each manual shall be an appropriately sized 3-ring binder with a vinyl cover and printed spine and cover labels. Each section shall have a printed divider tab. Each section shall be listed in a table of contents at the beginning of the manual.

END OF SECTION

(ELECTRONIC DOCUMENT RELEASE & SUBSTITUTION REQUEST FORMS ATTACHED)

Document Release Form

Information Requested:

Project Name:
Drawings Requested:

Media Type: (Check all that are applicable)

☐ AutoCAD DWG Files (Version _____)	☐ Adobe PDF Files
☐ REVIT Files (Version _____)	☐ Other

Requesting Party:

Name:	Address 1:
Company:	Address 2:
Signature:	Email Address:
Date:	Phone #:

KEDbluestone Use:

Form Sent By:	Date:

KEDbluestone Project #:

Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or subconsultants that may arise out of or in connection with your use of the electronic files. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by us and the electronic files, the signed or sealed hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display.

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SUBSTITUTION REQUEST FORM (DURING BIDDING)

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

PROJECT: _____

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

Proposed Substitution: _____

MANUFACTURER	TRADE NAME	MODEL NO.
_____	_____	_____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by the substitution.

Submitted by:

Signature

Firm

Telephone Email Date

Engineer's Review and Action

- ☐ Substitution Approved
- ☐ Substitution Approved As Noted
- ☐ Substitution Rejected
- ☐ Substitution Request Received Too Late

Signed by:

_____ Date

Supporting Data Attached:

- ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other _____

SUBSTITUTION REQUEST FORM (AFTER BIDDING)

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

PROJECT: _____

SPEC. SECTION	SPEC. TITLE	PARAGRAPH	SPECIFIED ITEM

_____	_____	_____	_____

Proposed Substitution: _____

MANUFACTURER	TRADE NAME	MODEL NO.

_____	_____	_____

INSTALLER	PHONE NO.

_____	_____

History: ☐ New Product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days

Savings to Owner for accepting substitution: \$ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including Architectural and Engineering design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by:

Signature

Firm

Telephone

Email

Date

Engineer's Review and Action

- ☐ Substitution Approved
- ☐ Substitution Approved As Noted
- ☐ Substitution Rejected
- ☐ Substitution Request Received Too Late

Signed by:

Date

Supporting Data Attached:

☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other _____

SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the following systems identification indicated by the Contract Documents with supplementary items necessary for proper installation.
- B. The contractor shall develop and submit for approval a labeling system for the structure cabling installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the structured cabling system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the structured cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

1.2 REFERENCES

- A. Several industry standards define the identification of the network physical infrastructure. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. TIA-942 Telecommunications Infrastructure Standard for Data Centers
 - 2. TIA/EIA-606B Administration Standard for Telecommunication Infrastructure
 - 3. NFPA 70E-2004 Standard for Electrical Safety in the Workplace
- B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1.3 SUBMITTALS

- A. Product Data: The Contractor shall submit catalog cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten and/or highlighted to indicate exact selection. Identify applicable specification section reference for each product.
- B. Qualification Data: For firms and person specified in "Quality Assurance" Article.

1.4 QUALITY ASSURANCE

- A. Provided products shall meet the following requirements: Items of the same classification shall be identical. This requirement includes equipment, assemblies, parts and components.

- B. Assure that the “as installed” system is correctly and completely documented including engineered drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.
- C. Materials and equipment: Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, and vibration conditions encountered at the installed location. The equipment shall meet the following requirements:
 - 1. Interior controlled environment: 60 to 100 degrees F dry bulb and 20 to 90 percent relative humidity, non-condensing.
 - 2. Interior uncontrolled environment: 0 to 130 degrees F dry bulb and 10 to 95 percent relative humidity, non-condensing.
 - 3. Listing and Labeling: Provide products specified in this Section that are listed and labeled, as defined in the NEC Article 100.

PART 2 - PRODUCTS

2.1 EQUIPMENT TYPE

- A. All label printing will be machine generated by Panduit Easy-Mark labeling software and Panduit desktop and hand-held printers using indelible thermal transfer ribbons or cartridges. Panduit self-laminating labels or Turn-Tell™ labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
 - 1. Computer Printable Labels
 - a. Machine generated labels provide clear communication. Labels are designed for specific data center infrastructure applications insuring a proper fit and long life.
 - b. Data cables shall be identified with self-laminated cable markers that can be rotated for visibility from any angle, and allow repositioning on the cable to align legends for improved aesthetics (Turn-Tell Labels).
 - c. Cabinets and equipment shall be identified with thermal transfer printed, die-cut, microcellular foam with a polyester printable surface and high-tack adhesive (Raised Panel Labels).
 - d. Fiber Optic cables shall be identified with non-adhesive, thermal transfer printable, flag style markers that permit the repositioning of the marker for greater visibility and improved aesthetics (Flag Labels).
 - e. Cable bundle shall be identified with non-adhesive thermal transfer printable marker plates attached with nylon cable ties or hook and loop ties. Marker plates shall offer crisp, clear legends and shall meet requirements for MIL-STD-202G, Notice 12 Method 215J (Thermal Transfer Printable Marker Plates).
 - 2. Easy-Mark Labeling Software
 - a. The Labeling Software insures that data center infrastructure identifiers conform to applicable Standards.
 - b. Labels and identifiers shall be produced with labeling software that guides the user through the process of creating labels used throughout the data center providing

- c. faster and more reliable infrastructure identification (Easy-Mark Labeling Software). Labels and identifiers shall be produced with labeling software that facilitates quick and easy extraction of identifiers from CAD drawings saving time and reducing errors caused by manual entry of data into labeling software (CAD-Connect Labeling Software)

3. LS8EQ Portable Printing System

- a. The LS8EQ printer produces durable, clear identification labels on site.
- b. Labels and identifiers shall be printed on hand-held thermal transfer printer increasing labeling productivity. Printer labels shall be contained in fast loading label cassette containing an integrated memory device for automatic formatting, recall of last legend and number of labels remaining on the cassette. The printer shall provide a partial cut feature to allow the flexibility of tear-apart strips of labels for quicker installation.
- c. Labels and identifiers shall be printed on a compact and rugged portable thermal transfer printer that fits in one hand. The printer shall have a large, backlit display, QWERTY keyboard, USB interface for importing data and printing labels from a wireless laptop or desktop computer. Printer shall simplify the creation of labels for network components through built-in data center labeling tools. Printer labels shall be contained in fast loading label cassette containing an integrated memory device for automatic formatting, recall of last legend and number of labels remaining on the cassette. The printer shall provide a partial cut feature to allow the flexibility of tear-apart strips of labels for quicker installation (LS8EQ).

4. Physical Network Security Devices

- a. Physical Network Security devices insure that network connection points are protected from unauthorized or unintended access or disconnection.
- b. RJ45 Plug Lock In Device
- c. RJ45 Plug Block-out Device

2.2 ACCEPTABLE MANUFACTURERS

- A. Panduit (Basis of Design)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. TIA/EIA-606-B: Two (2) classes of administration are specified in the standard, to accommodate diverse degrees of complexity present in the telecommunications infrastructure. The specifications for each class include requirements for identifiers, records, and labeling.
 - 1. Class 1: Address the administration needs of a premises that is served by a single telecommunications space (TS) containing its telecommunications equipment. Required in Class 1 administration are identifiers for the TS, cabinets or racks, patch panels and termination blocks, ports or termination block positions, patch cables, cabling subsystem 1 links or horizontal links, equipment and workspace outlets, consolidation points, zone enclosures, splices, and all telecommunications grounding and bonding systems.

2. Class 2: Administration provides for telecommunications infrastructure administration needs of a single building or tenant that is served by a single or multiple TS's within a single building. Class 2 administration includes all elements of Class 1 administration, plus identifiers for cabling subsystem 2 and 3 or backbone cabling, cabling subsystem 2 and 3 ports, and firestopping locations.

B. Telecommunication Space Labeling

1. Each TS should be identified with a scheme that defines the location of the space. The location should be defined with the floor and room number or other room designation. A typical telecommunication space would have the following scheme: 1DC2. This identifier would define that this is DATA CENTER 2 LOCATED ON THE FIRST FLOOR OF THE BUILDING.

C. Component Locations in the Telecommunications Space

1. Locations for components in the TS can be determined either by using the grid coordinates for the space or assigning unique numbers to the various cabinet and wall segments in the space.

3.2 NETWORK SWITCHES

A. Port Labeling

1. Port identifiers are very important in that they will define the connectivity of cabling within the data center infrastructure. Many patch panels come from the factory with numbers already screen-printed above the ports. If this is the case then there is no need to re-label those patch panels. If the patch panels are not pre-printed with port numbers then labels will need to be created to identify the port numbers. The numbering sequence should proceed from left to right and top to bottom for all ports on a patch panel. The number of digits used for all numbers on a patch panel should be consistent with the total number of ports on that patch panel. For example a 48-port patch panel should be labeled 01 through 48 and a 144-port patch panel should be labeled 001 through 144.



2. A typical port label would have the following scheme: AB04-24:12. This identifier can be decoded to define that this port 12 located on panel 24 in cabinet/rack AB04. This is somewhat redundant information given that the cabinet/rack and panel are clearly

identified and are not usually required information on the port label since the cabinet/rack and panel are apparent to the viewer who is standing at the location of the port. Therefore, a typical port label would have the following scheme: 12. This identifier defines that this is port 12.

3. Port Label Recommendations:

Printer Type	Laser/Inkjet				
Cable Type	Copper	Copper	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Non-Adhesive	Non-Adhesive	Adhesive
Number of Ports	4	6	4	6	n/a
Label P/N	C261X030FJJ	C379X030FJJ	C261X035Y1J	C390X030Y1J	C350X100YJJ

Printer Type	LS8E				
Cable Type	Copper	Copper	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Non-Adhesive	Non-Adhesive	Adhesive
Number of Ports	4	6	4	6	n/a
Label P/N	C252X030FJC	C379X030FJC	C261X035Y1C	C390X030Y1C	T100X000YPC-BK

Printer Type	Desktop Thermal		
Cable Type	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Adhesive
Label P/N	C252X030YPT C252X030APT	C379X030YPT C379X030APT	C350X100YJT

B. Cable Labeling and Patch Cord Labeling

1. Cabling on the back and front of the cabinet/rack must be identified. Labeling of cables on the back of the panel is considered cable labeling and the labeling of cables connected to the front of the patch is considered patch cord/equipment cord labeling.
2. Cable labels are identified with information that defines the connection between the near end panel connection and the far end panel connection. A near end connection identifier would consist of the cabinet/rack location, panel location, and port location. The far end connection identifier would consist of the cabinet/rack location, panel location and port location.



- a. A typical cable label would have information in the following scheme: AB04-24:01/AB07-36:13. This identifier would be decoded to define the cable connects between cabinet AB04 panel 24 port 01 going to cabinet AB07 panel 36 port 13. The far end of the cable would have a label that would have the same but with the information reversed.
- b. Recommended Cable Labels:

Printer Type	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Flag	Flag	Self-Laminating
Label P/N	S100X150YAJ	S100X225YAJ	F102X220FJJ	F102X220FJJ	S100X225YAJ

Printer Type	LS8	LS8	LS8	LS8	LS8
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating for Label-Core	Self-Laminating for Label-Core	Self-Laminating
Label P/N	S100X150VAC R100X150V1C	S100X225VAC R100X150V1C	S100X160VAC	S100X220VAC	S100X225VAC

Printer Type	Desktop Thermal	Desktop Thermal	Desktop Thermal
Cable Type	Copper	Copper	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X150VAT R100X150V1T	S100X225VAT R100X225V1T	S100X225VAT R100X225V1T

3. Patch Cord/Equipment Cord Labels are identified with information that defines the connection between the near end patch panel front connections and the far end patch

panel front connections or equipment connections. A near end connection identifier would consist of the cabinet/rack location, panel location, and port location. The far end connection identifier would consist of the cabinet/rack location, panel location, and port location.



- a. A typical patch cord label would have information in the following scheme: AB04-24:12\AB04-36:24. This identifier would be decoded to define the patch cord connection between cabinet AB04 panel 24 port 12 going to the same cabinet panel 36 port 24. The far end of the cable would have a label that would have the same but with the information reversed.
- b. A typical equipment cord label would have information in the following scheme: AB04-24:01\AB04-Tinley2:A. This identifier would be decoded to define the equipment cord connection between cabinet AB 04 panel 24 port 01 going to the same cabinet port A on equipment named Tinley2. Rack unit location could be substituted for equipment name if necessary.
- c. Recommended Patch/Equipment Cord Labels:

Printer Type	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Flag	Flag	Self-Laminating
Label P/N	S100X150YAJ	S100X225YAJ	F102X220FJJ	F102X220FJJ	S100X225YAJ

Printer Type	LS8	LS8	LS8	LS8	LS8
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating for Label-Core	Self-Laminating for Label-Core	Self-Laminating
Label P/N	S100X150VAC R100X150V1C	S100X225VAC R100X150V1C	S100X160VAC	S100X220VAC	S100X225VAC

Printer Type	Desktop Thermal	Desktop Thermal	Desktop Thermal
Cable Type	Copper	Copper	Copper
Cable Diameter	Cat5/5e/6	10G UTP/STP	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X150VAT R100X150V1T	S100X225VAT R100X225V1T	S100X225VAT R100X225V1T

4. Patch Panel Connectivity defines the connections between the near-end ports and the far-end ports. This labeling can define the connection of a range of ports on a panel or just define the connection for two (2) individual ports.



- a. A typical patch panel connectivity label would have the following scheme: AB04-24: ports 01-12/AB04-36: ports 12-24. This identifier would describe that ports 01 through 12 on panel 24 of cabinet AB04 connect to ports 12 through 24 on panel 36 of cabinet AB04.
- b. Recommended Patch Panel Connectivity Labels:

Printer Type	Laser/Inkjet		
Media	Copper	Copper	Fiber
Ports	4 or less	More than 4	n/a
Label P/N	C252X030FJJ	C379X030FJJ	C350X100YJJ

Printer Type	LS8		
Media	Copper	Copper	Fiber
Ports	4 or less	More than 4	n/a
Label P/N	C252X030FJC	C379X030FJC	T100X000VJC-BK

Printer Type	Desktop Thermal		
Media	Copper	Copper	Fiber
Ports	4 or less	More than 4	n/a
Label P/N	C252X030YPT	C379X030YPT	C350X100YJT

C. Labeling for Other Systems

1. In addition to the data connections there are many other systems in a data center that require labeling.

3.3 GROUNDING AND BONDING

- A. Labeling of the grounding and bonding system involves the identification of the main grounding busbar, grounding busbars, conductors connecting busbars, conductors connecting devices to busbars, and equalizing conductors.

1. The typical scheme for the main grounding busbar would be: 1-B301-TMGB. This identifier can be decoded to define that this is the main telecommunications grounding busbar located on Floor 1 in Space B301.
2. The typical scheme for a grounding busbar would be: 2-R201-TGB. This identifier can be decoded to define that this is the telecommunications grounding busbar on Floor 2 in Space R201.

a. Recommended Telecommunications Grounding Busbar Labels

Printer Type	Laser/Inkjet	LS8	Desktop Thermal
Label P/N	C400X200YJJ	C200X100YPC	C400X200YPT

3. The typical scheme for the busbar connections would be: 1-B301-TMGB/2-R201-TGB. This identifier can be decoded to define that this is the conductor that connects the main telecommunications grounding busbar located on Floor 1 in Space B301 to the telecommunications grounding busbar on Floor 2 in Space R201.

a. Recommended Busbar Connections Labels

Printer Type	Laser/Inkjet				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075YAJ	S100X125YAJ	S100X225YAJ	S100X400YAJ	S100X650YAJ

Printer Type	LS8				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAC	S100X125VAC	S100X225VAC	S100X400VAC	S100X650VAC

Printer Type	Desktop Thermal				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAT	S100X125VAT	S100X225VAT	S100X400VAT	S100X650VAT

END OF SECTION

SECTION 27 08 00
WARRANTY OF STRUCTURED CABLING

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the Structured Cabling indicated by the Contract Documents with supplementary items necessary for proper installation and guarantee of warranty.

1.2 SUBMITTALS

- A. Product Data

1.3 QUALITY ASSURANCE

- A. Manufacturer's Warranty and Application Assurance
 - 1. The Structured Connectivity Solutions Extended Manufacturer's Warranty and Application Assurance
 - a. The extended manufacturer's warranty, for a minimum of 1 year from the date of occupancy, shall include providing replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for the period indicated above.
 - b. Minimum one (1) year application assurance: The application assurance shall cover the failure of the wiring system to support the application which it has designed to support, as well as additional application(s) introduced in the future for a minimum one (1) year period.
 - c. System certification: Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate, from the manufacturer(s), registering the installation.
 - 2. Term of Warranty
 - a. The warranty period will be for a minimum of one (1) year from the date of occupancy.
 - b. Moves, additions or changes are covered by the original registration certificate if performed by a Manufacturer Business Partner in compliance with the Manufacturer SCS design, installation and registration requirements.
 - c. Administration of Manufacturer SCS cords by the end user is covered by the original registration certificate.
 - 3. Person / Entity Covered
 - a. This warranty is for the sole benefit of the person or entity to whom the Manufacturer Solution's registration certificate is issued and any successor in interest to the site in which such Registered Manufacturer SCS was originally installed.

B. Testing and Inspection of Communications Equipment

1. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.
 - a. Furnish all test equipment and instruments required for the tests.
 - b. Responsible, qualified employees of the contractor in the presence of the Owner or an authorized representative shall perform the cable testing.
 - c. All individuals involved in the testing phase of the project shall not have been involved in the installation phase nor shall have immediate knowledge of the installation task.
2. End to end performance of all parts and channels will be tested.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 27 08 20
ACCEPTANCE OF COMMUNICATIONS COPPER CABLING

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the required remote control and signal cabling indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- D. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them. See Section 207513.

1.3 SUBMITTALS

- A. See Section 270513
- B. A schedule (list) of all copper cables to be tested.
- C. Sample test reports
- D. Copy of latest calibration report of used test equipment.

1.4 QUALITY ASSURANCE

- A. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals). These certificates may have been issued by any of the following organizations or an equivalent organizations:
 - 1. Manufacturer of the copper cable and/or copper connectors.
 - 2. Manufacturer of the test equipment used for the field certification.
 - 3. Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida; ACP [Association of Cabling Professionals™] Cabling Business Institute located in Dallas, Texas)

- B. The test equipment shall be within the calibration period recommended by the manufacturer in order to achieve the manufacturer-specified measurement accuracy.
- C. The Owner or the Owner's representative shall be invited to witness and/or review field-testing.
- D. The Owner or the Owner's representative shall be notified of the start date of the testing phase five (5) business days before testing commences.
- E. The Owner or the Owner's representative will select a random sample of 10% of the installed links. The Owner or the Owner's representative shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation Contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation Contractor under supervision of the representative shall repeat 100% testing at no cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 COPPER CERTIFICATION TESTERS

- A. The field-test instrument shall be within the calibration period recommended by the manufacturer.
- B. Test equipment (tester) for:
- C. Acceptable Manufacturer
 - 1. Fluke Networks
 - 2. Or approved equal

PART 3 - EXECUTION

3.1 GENERAL

- A. Every cabling link in the installation shall be tested for
 - 1. Wire map
 - 2. Length
 - 3. Insertion Loss
 - 4. NEXT Loss

5. PS NEXT Loss
6. ACR-F Loss
7. PS ACR-F Loss
8. Return Loss
9. Propagation Delay
10. Delay Skew

- B. End-to-end cabling will be considered defective if it does not pass tests and inspections, based on Category 6 performance specifications chart below.

Parameter	Category 6
Specified Frequency Range	250 MHz
Attenuation	19.8
NEXT	44.3 dB
Power-Sum NEXT	37.1 dB
ACR	18.6 dB
Power-Sum ACR	20.3 dB
ELFEXT	27 dB
Power-Sum ELFEXT	24.8 dB
Return Loss	20.1 dB
Propagation Delay	548 nsec
Delay Skew	50 nsec
Network 5 Supported	1000 Base-TX

- C. Alien Crosstalk testing is not required. Please get confirmation hereof from the Owner before testing.
- D. The installed twisted-pair horizontal links shall be tested from the Telecommunications Room to the wall outlet in the work area.
- E. The test plug shall fall within the values specified in the applicable standard (CAT6) for NEXT Loss, FEXT Loss and Return Loss.
- F. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester than can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Contractor shall provide proof that the interface has been

calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

- G. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*). When the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. To which extent “*” results shall determine approval or disapproval of the element under test shall be defined in the relevant detail specification, or agreed on as a part of a contractual specification.

3.2 CERTIFYING COPPER CABLE

- A. Category 6
 - 1. All tests should be in accordance with the field test specifications defined in ANSI/TIA/EIA-568-B.2-1. “Addendum 1 – Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling.” This document will be referred to as the “Category 6 Standard.”
 - 2. The test parameters are defined in the Category 6 Standard. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test, all measurements (at each frequency in the range from 1 MHz through 250 MHz) must meet or exceed the limit value determined in the above-mentioned standard.

3.3 ACCEPTANCE OF COPPER TEST RESULTS

- A. One hundred percent of the installed cabling links must pass the requirements of the applicable standards. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the final test results documentation, which shall be reviewed, approved and signed by the Contractors RCDD.
- B. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

3.4 ADMINISTRATION

- A. Test results documentation
 - 1. Test results saved within the field-test instrument shall be transferred into a FLW file so it can be uploaded to Fluke Networks LinkWare software that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument.”
 - 2. The test results documentation shall be available for inspection by the Owner or the Owner's representative during the installation period and shall be passed to the Owner's representative within five (5) working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.

3. The database for the complete project shall be stored and delivered on CD-ROM prior to Owner acceptance of the building. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports.
4. Circuit IDs reported by the test instrument should match the specified label ID.
5. The detailed test results documentation data is to be provided in an electronic database for each tested copper cable and shall contain the following information.
 - a. The identification of the customer site as specified by the Owner.
 - b. The name of the test limit selected to execute the stored test results.
 - c. The name of the personnel performing the test.
 - d. The date and time the test results were saved in the memory of the tester.
 - e. The manufacturer, model and serial number of the field-test instrument.
 - f. The version of the test software and the version of the test limit database held within the test instrument.
 - g. The copper identification number.
 - h. The length for each copper cable.
 - i. The overall Pass/Fail evaluation of the copper link-under-test.

END OF SECTION

**SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the required remote control and signal cabling indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- D. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them. See Sections 270513.

1.3 SUBMITTALS

- A. See Section 270513.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installation Supervision: Installation will be under the direct supervision of a Registered Technician who will be present at all times when Work of this Section is performed at Project site.
- 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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.
- E. Hole spacing and mechanical dimensions: Comply with EIA-310.

1.5 TELECOMMUNICATION ROOMS

- A. The Telecommunications Room is generally considered to be a floor serving facility. The horizontal cross-connect links the horizontal subsystem and the backbone subsystem together.
- B. The Telecommunications Rooms shall have a minimum dimension of 10' x 10' square.
- C. L-shaped or other shaped dimensions are not acceptable.
- D. Concrete columns in this area are not acceptable.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.

3.2 OUTLET BOXES

- A. Outlet boxes shall be assembled as follows
 - 1. Depth: 3.26 inches
 - 2. Height: 4.16 inches
 - 3. Width: 3.51 inches

3.3 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated (both sides), $\frac{3}{4}$ by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06.
- B. Plywood should be installed 1 foot above finished floor.

3.4 LIGHTNING PROTECTION

- A. Contractor shall provide multi-pair protector panel(s), including mounting and termination hardware. The multi-pair protector panel(s) shall be UL listed.
- B. For small pair count applications (less than or equal to 200-pairs), the multi-pair protector panel shall consist of a mounting panel for a series of solid-state protector units, 710-type connector for input, and 110-type termination blocks for output. Insertion of the protector units into the mounting panel will complete the circuit. The multi-pair protector panel(s) shall be available in 25-, 50-, 100-, and 200-pair counts.
- C. Solid State Protection Units:
 - 1. Over Voltage DC Breakdown Voltage: 75V-480V.
 - 2. DC Holdover Current: Clears within 20ML.
 - 3. Capacitance: Less than <200 pF.
 - 4. Rated Impulse Capability: Unlimited @100A safety: Fail safe mechanism fast acting balanced.

3.5 DEMARCATION REQUIREMENTS

- A. Contractor shall coordinate with owner's selected service provider all requirements for the demarcation point.
- B. In the event that the service provider's requirements differ from the work shown on the documents, the contractor shall not proceed on the installation without a document from the engineer.

3.6 COMMUNICATION SYSTEM GROUNDING

- A. Refer to Specification Section 260526.

3.7 TELECOMMUNICATIONS ROOM

- A. The telecommunication room shall house racks voice termination fields and required cable routing hardware. Racks shall be placed in a manner that will allow a minimum of three (3) feet of clearance from the front and rear mounting surfaces and on one side on racks. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6" to the wall to allow room for vertical management.
- B. Voice termination fields shall be mounted on 4' x 8' x 3/4" virgin fire retardant plywood, unless otherwise noted in drawings. Backbone termination fields shall be mounted to the left of the horizontal voice fields.

END OF SECTION

**SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING**

PART 1 - GENERAL

1.1 SCOPE

- A. Perform all Work required to provide and install the required remote control and signal cabling indicated by the Contract Documents with supplementary items necessary for proper installation.

1.2 REFERENCES

- A. See Section 270513.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
- D. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- E. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1.3 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the Telecommunication Room or Equipment Room.
 - 1. Horizontal cabling shall contain no transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.
- C. Color and cable type designations UTP cable:
 - 1. WAPs: UTP CAT6, Blue

PART 2 - PRODUCTS

2.1 MANUFACTURER HORIZONTAL CABLING

- A. Panduit TX 6000 Enhanced System
- B. Commscope Uniprise System
- C. Belden-Belden
- D. Hubble

2.2 UTP CABLE

- A. Horizontal UTP Cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be blue for WAP applications. Conductors shall be four (4)-pair solid untinned copper 23 AWG. Cable shall be plenum rated CMP per NFPA 70.

2.3 UTP CABLE HARDWARE

- A. Copper Patch Cords: Owner provided / installed.

2.4 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Cables shall be terminated with connecting hardware of same category or higher.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Horizontal UTP cable must be terminated using 8-conductor, 8-position connectors. The pin/pair assignment will be T568B. Use color matching icon.
- D. Install plenum cable in environmental air spaces, including plenum ceilings.
- E. Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When

there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

- F. Provide service loops above the ceilings at the workstation location and in the telecommunication closet. At the workstation provide a minimum cable slack of 12-inches for UTP, cables and 40-inches for optical fiber cables. In the telecommunication closets provide a minimum cable slack of 10-feet for both UTP and optical fiber cables. Cable slack shall be neatly installed and supported by ladder rack and ladder rack drop outs above the vertical wire managers in the equipment racks.
- G. Unshielded Twisted Pair Cable: Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. Pairs shall remain twisted together to within the proper distance from the termination. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket. The pulling tension on a four (4)-pair UTP cables shall not exceed 25 lbs. for a single or bundle of cables.

3.2 COORDINATION

- A. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area with General Contractor/Owner. The telecommunications outlet/connector shall be in close proximity to the power receptacles in each work area.

3.3 INSTALLATION OF CABLES

- A. General Requirements for Cabling
 - 1. MUTOA shall not be used.
 - 2. Horizontal Distribution Cable. All cables shall be installed in a continuous raceway from each data outlet box to accessible space above ceiling. Outlet box shall be 4"x 4" x 2-1/8" deep box with single gang plaster ring. Provide a continuous raceway to telecommunication closet in areas without accessible ceilings. Conduit size shall be 1-inch minimum. Horizontal cabling installed in/out of cable tray shall be bundled at not less than 4' intervals with hook and loop tie wraps. The use of plastic cable ties is strictly prohibited. Provide insulated bushing at each end of conduit prior to installation of cable. The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Copper cable not in a wire raceway, shall be suspended a minimum of 8-inches above ceilings by cable supports no greater than 48-inches apart. Cable shall not be run through structural members or in contact with pipes, ducts or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12-inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Service loops shall have a 3 feet per cable located at the ceiling at the last support (ex. J-hook, etc.) before entering cable into conduit, wall, and surface raceway.

END OF SECTION

