BIDDING DOCUMENTS
PROJECT MANUAL
Volume One: Divisions 00-01
for the

ST. JOHN THE BAPTIST PARISH
WESTBANK PUBLIC SAFETY COMPLEX
5739 Highway18, Edgard, LA 70049

Owner:

ST. JOHN the BAPTIST PARISH
NATALIE ROBOTTOM, PARISH PRESIDENT

Prepared by:

ARCHITECT:
SIZELER THOMPSON BROWN ARCHITECTS
REGIONAL DESIGN GROUP, LLC
300 LAFAYETTE STREET, SUITE 200
NEW ORLEANS, LOUISIANA 70130
(504) 523-6472

Consultants:

STRUCTURAL & CIVIL ENGINEERS:
FOX - NESBIT
900 Camp Street, Suite 360
New Orleans, LA 70130
Tel: (225) 293-6595

MECHANICAL & ELECTRICAL ENGINEERS:
MOSES ENGINEERS
909 POYDRAS STREET, SUITE 2150
NEW ORLEANS, LA 70112
Tel: (504) 586.1725

ARCHITECT'S PROJECT No:
21238.00

OCTOBER 15, 2018

Set No. _____

INTRODUCTORY INFORMATION

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300 Lafayette Street, Suite 200
New Orleans, LA 70130
Phone: 504-523-6472
Fax: 504-529-1181

www.sizelerthompsonbrown.com

DOCUMENT 00 0103

PROJECT DIRECTORY

OWNER:

ST. JOHN THE BAPTIST PARISH
WESTBANK PUBLIC SAFETY COMPLEX
5739 HIGHWAY 18
EDGARD, LA 70049

ARCHITECT:

SIZELER THOMPSON BROWN ARCHITECTS
REGIONAL DESIGN GROUP, LLC
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Tel: (504) 523-6472
Principal-in-Charge: Thomas Brown
SR. Project Manager: P. Randy Fiveash

STRUCTURAL and CIVIL ENGINEER:

FOX-NESBIT ENGINEERING, LLC
900 CAMP STREET, SUITE 360
NEW ORLEANS, LA 70130
Tel: (225) 293-6595

MECHANICAL and ELECTRICAL ENGINEER:

MOSES ENGINEERS
909 POYDRAS STREET, SUITE 2150
NEW ORLEANS, LA 70130
Tel: (504) 586-1725

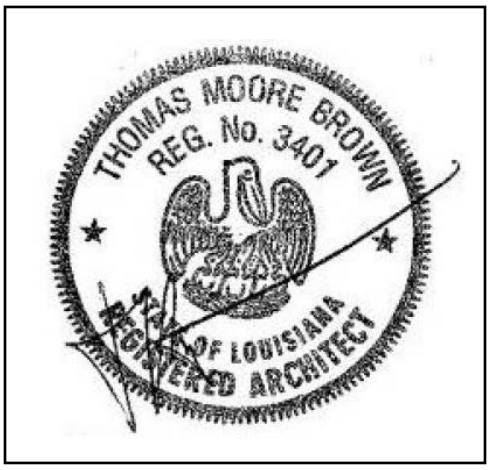
END OF DOCUMENT

DOCUMENT 00 0107
PROFESSIONAL SEALS

PROJECT NAME: **ST. JOHN THE BAPTIST PARISH**
WESTBANK PUBLIC SAFETY COMPLEX
5739 Highway 18
Edgard, Louisiana 70049

DATE: **October 15, 2018**

ARCHITECTURAL SPECIFICATIONS: The following specification Sections were prepared by me or under my direct personal supervision:



Sizeler Thompson Brown Architects

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END OF ARCHITECTURAL

CIVIL SPECIFICATIONS: The following specification Sections were prepared by me or under my direct personal supervision:

Fox – Nesbit Engineering, LLC

31 1000 Site Clearing
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32 1313 Cement Concrete Pavement
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33 1416 Site Water Distribution
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END OF CIVIL

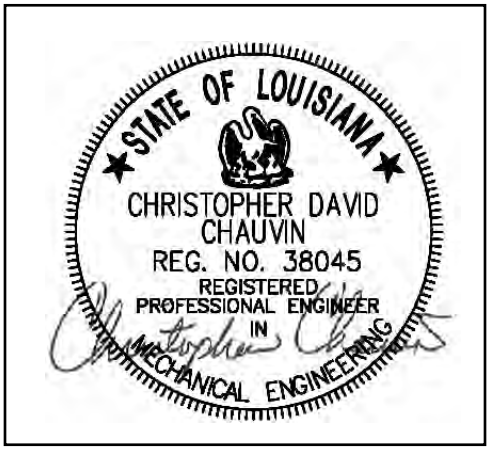
STRUCTURAL SPECIFICATIONS: The following specification Sections were prepared by me or under my direct personal supervision:

Fox - Nesbit Engineering, LLC

03 3000 Cast-in-Place Concrete
05 1200 Structural Steel Framing
05 4000 Cold-Formed Metal Framing
31 2110 Earth Moving - Building Pad
31 6219 Timber Piles

END OF STRUCTURAL

MECHANICAL AND PLUMBING SPECIFICATIONS: The following specification Sections were prepared by me or under my direct personal supervision:



Moses Engineers

21 0500	Common Work Results for Fire Suppression
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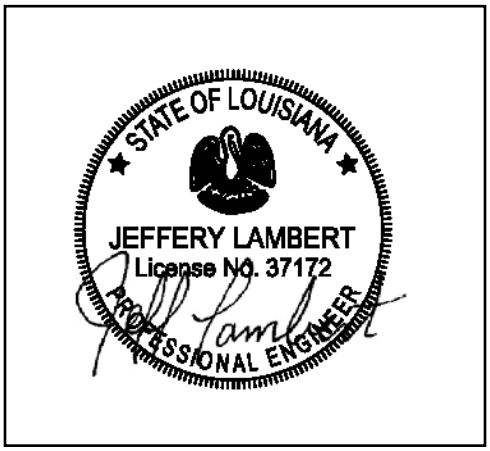
END OF MECHANICAL AND PLUMBING

ELECTRICAL SPECIFICATIONS: The following specification Sections were prepared by me or under my direct personal supervision:



27 5123 Intercommunications and Program Systems
28 3111 Digital, Addressable Fire-Alarm System

Moses Engineers

26 0500 Common Work for Electrical
26 0519 Low-Voltage Electrical Power Conductors and Cables
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BIDDING REQUIREMENTS

Sizeler Thompson Brown Architects
300 Lafayette Street, Suite 200
New Orleans, LA 70130
Phone: 504-523-6472
Fax: 504-529-1181

www.sizelerthompsonbrown.com

DOCUMENT 00 1113

ADVERTISEMENT FOR BIDS

A. Advertisement for Bids: The Advertisement for Bids to be used for this Project shall be as provided by the Parish of St. John the Baptist and is bound in the Project Manual following this page.

END OF DOCUMENT

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ADVERTISEMENT FOR BIDS

WESTBANK PUBLIC SAFETY COMPLEX

Sealed bids will be received by St. John the Baptist Parish until **2:45 p.m. on December 11, 2018.** Bids may be delivered to the receptionist at the President's Office, in the Percy Hebert Building located at 1801 West Airline Hwy., LaPlace, LA Bids will be opened and read aloud at **3:00 p.m. December 11, 2018** in the Joel S. McTopy Council Chambers of the Percy Hebert Building, 1801 W. Airline Hwy., LaPlace, LA.

Complete bidding documents may be obtained from:

Purchasing and Procurement Department
St. John the Baptist Parish
1801 W. Airline Hwy.
LaPlace, LA 70068
985-652-9569

Details may be viewed, downloaded and are being accepted at www.centralbidding.com. Bid Documents may also be viewed and downloaded on the Parish website, www.sjbparish.com.

All bidders must show proof that he or she is licensed in the State of Louisiana for Building Construction. Contractor's license number must be on the face of the sealed envelope containing the bid. The envelope must be designated as

"Sealed Bid – Westbank Public Safety Complex

St. John the Baptist Parish Council, being a government agency, is exempt from all sales tax. The vendor awarded the contract will be provided documentation to support their tax free purchases for this project. Therefore, the amount you bid should contain no sales tax.

A mandatory pre-bid meeting will be held on Thursday, November 27, 2018 at 1:30 PM in the Joel S. McTopy Council Chambers located at 1801 West Airline Hwy. in LaPlace, LA. All Prime Bidders are required to attend the entire pre-bid conference to be eligible to bid. Any prime Bidders arriving after the start of the pre-bid conference will not be considered in attendance, and will not be eligible to bid. Although not required, Non-Prime Bidders and material suppliers are urged to attend**.**

The bid must be accompanied by a bid security equal to five percent (5%) of the base bid and must in the form of a certified check, cashier's check or bid bond written by a company licensed to do business in Louisiana. The successful bidder will be required to furnish a Performance Bond written by company licensed to do business in Louisiana, in the amount equal to one hundred percent (100%) of the Bid amount. Certificates of Insurance will also be required.

No bidder may withdraw his/her Bid within forty-five (45) days after the actual date of opening thereof.

St. John the Baptist Parish reserves the right to accept or reject any and all bids and to waive any irregularities or informalities incidental thereto, and to accept any bid which the Council feels serves their best interest. Such action shall be in accordance with LA Revised Statute 38.

Any person with disabilities requiring Special Accommodation must contact the St. John the Baptist Parish Council Office at (985) 652-9569 no later than seven (7) days prior to bid opening.

Participation by minority and female-owned businesses, as well as businesses located in this Parish, is encouraged.

ST. JOHN THE BAPTIST PARISH COUNCIL

Publish:
November 7, 2018
November 14, 2018
November 21, 2018

DOCUMENT 00 2113

INSTRUCTIONS TO BIDDERS

A. **Instruction to Bidders:** The Instructions to Bidders to be used for this Contract for Construction shall be **A.I.A. Document A701, Instructions to Bidders - 1997 Edition** and are bound in the Project Manual following this page.

B. **Supplementary Instructions to Bidders:** The instructions to Bidders for this Contract are modified, amended and supplemented directly into the A.I.A. document.

END OF DOCUMENT

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AIA® Document A701™ – 1997

Instructions to Bidders

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

Roland Borne Memorial Library Expansion
St. John the Baptist Parish
2979 LA Highway 18
Edgard, LA 70049

A renovation and addition to the existing Roland Borne Memorial Library located in Edgard, Louisiana

THE OWNER:
(Name, legal status and address)

St. John the Baptist Parish Library Board
2920 Highway 51
LaPlace, LA 70068

THE ARCHITECT:
(Name, legal status and address)

Sizeler Thompson Brown Architects
Regional Design Group, LLC
300 Lafayette Street, Suite 200
New Orleans, LA 70130

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

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

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 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.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 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.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded. For clarification, the term "good condition" throughout this document shall mean:

1. Complete Drawings, Project Manual, and all Addenda issued prior to the return of the Documents.

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2. All documents listed above shall be bound as originally issued.

3. All documents listed above shall be free from permanent marks including, but not limited to, permanent ink and highlight markers.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders 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.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 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 errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least seven (7) working days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

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§ 3.4.3 Addenda will be issued no later than 72 hours not including weekends and holidays prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.1.1 Contractor shall be licensed in the State of Louisiana at the time of the submission of the Bid. Contractors shall include their license number on the bid envelope in accordance with LA R.S 37:2163A.

§ 4.1.1.2 Contractor shall refer to Specification Section 00 3119 – "Existing Condition Information" and the contents of Appendix C of this Specification in determining the Bid.

§ 4.1.1.3 Bids shall include the following items:

Louisiana Uniform Public Work Bid Form
Bid Bond
Corporate Resolution (Document 00 4543)
Evidence of Agency, Corporate, or Partnership Authority (Document 00 4510)

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

§ 4.1.7.1 Bid security shall be not less than five (5%) percent of the amount of the bid. Bid Security shall be submitted on the bid bond document included.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

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§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, project name for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic or facsimile bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid. In accordance with LA R.S. 38:2214 (C) & (D), bids may only be withdrawn after the bid opening if there are obvious, unintentional, and substantial mechanical, clerical, or mathematical errors. A withdrawn bid may not be resubmitted.

§ 4.5 DOCUMENTS REQUIRED AFTER BID

§ 4.5.1 Document 00 4520 - Corporate Resolution shall be signed, notarized and provided ten (10) days after bid due date. Document Attestation shall be signed by all bidders and provided within ten (10) days after bid due date.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.2.1 The Owner has the right to reject any and all bids for just cause in accordance with LA R.S. 38:2214B.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid

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which, in the Owner's judgment, is in the Owner's own best interests. Requirements set forth in the Advertisement for Bids and the Bid Form may NOT be waived as informalities.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- **.3** names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

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§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner on the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

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DOCUMENT 00 2119

!!!CAUTION TO BIDDERS!!!

BEFORE SIGNING AND SUBMITTING THIS BID, PLEASE REFER TO **"DOCUMENT 00 4393 - BIDDER'S CHECKLIST"** IN THIS PROJECT MANUAL.

FAILURE TO PERFORM ANY ONE OF THE ACTIONS LISTED ON THE "BIDDER'S CHECKLIST" MAY CAUSE YOUR BID TO BE REJECTED!!!

END OF DOCUMENT

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DOCUMENT 00 3132

GEOTECHNICAL DATA

A. **Geotechnical Investigation**: A Geotechnical Investigation was made at the project site by The Beta Group, 1428 ½ Claire ave., Gretna, LA 70053; phone: 504-227-2273, dated September 4, 2018. Neither the Owner, nor the Architect, nor the Engineer guarantees the accuracy of the soils information.

1. **Data indicating subsurface conditions** are not intended as representations or warrants of continuity of such conditions between soil borings. The Owner, Architect and Engineer will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data is made available for the convenience of the Contractor.
2. **Additional test borings** and other exploratory operations may be made by the Contractor at no additional cost to the Owner, provided they are acceptable to the Owner and the Architect.
3. **The above-referenced** geotechnical report is provided for the Bidder's use in preparing Bids and does not relieve the Bidders from doing their own investigation to determine the accuracy of the information.
4. **This investigative report** may be found in Appendix A at the end of the project specifications.
5. **THIS REPORT IS NOT PART OF THE CONTRACT DOCUMENTS.**

END OF DOCUMENT

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DOCUMENT 00 4113

BID FORM

A. Bid Form: The Bid Form(s) to be used for this Contract for this Contract for Construction shall be provided by the Parish of St. John the Baptist and are bound in this Project Manual following this page.

END OF DOCUMENT

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LOUISIANA UNIFORM PUBLIC WORK BID FORM

TO: St. John the Baptist Parish Council
1801 West Airline Hwy.
LaPlace, La 70068

(Owner to provide name and address of owner)

BID FOR: St. John the Baptist Parish
West Bank Safety Complex
5739 Highway 18
Edgard, La 70049

(*Owner to provide name of project and other identifying information)*

The undersigned bidder hereby declares and represents that she/he; a) has carefully examined and understands the Bidding Documents, b) has not received, relied on, or based his bid on any verbal instructions contrary to the Bidding Documents or any addenda, c) has personally inspected and is familiar with the project site, and hereby proposes to provide all labor, materials, tools, appliances and facilities as required to perform, in a workmanlike manner, all work and services for the construction and completion of the referenced project, all in strict accordance with the Bidding Documents prepared by: **Sizeler Thompson Brown Architects Regional Design Group, LLC** and dated: **October 15, 2018.**
(Owner to provide name of entity preparing bidding documents.)

Bidders must acknowledge all addenda. The Bidder acknowledges receipt of the following **ADDENDA:** (Enter the number the Designer has assigned to each of the addenda that the Bidder is acknowledging) _____ .

TOTAL BASE BID: For all work required by the Bidding Documents (including any and all unit prices designated "Base Bid" * but not alternates) the sum of:

_____Dollars ($ _____)

ALTERNATES: For any and all work required by the Bidding Documents for Alternates including any and all unit prices designated as alternates in the unit price description.

Alternate No. 1 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

As described in Section 01 2300 - Alternates_____Dollars ($ _____)

Alternate No. 2 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

N/A_____Dollars ($ N/A_____)

Alternate No. 3 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

N/A_____Dollars ($ N/A_____)

NAME OF BIDDER: _____

ADDRESS OF BIDDER:_____

_____

LOUISIANA CONTRACTOR'S LICENSE NUMBER: _____

NAME OF AUTHORIZED SIGNATORY OF BIDDER: _____

TITLE OF AUTHORIZED SIGNATORY OF BIDDER: _____

SIGNATURE OF AUTHORIZED SIGNATORY OF BIDDER **: _____

DATE: _____

* The Unit Price Form shall be used if the contract includes unit prices. Otherwise it is not required and need not be included with the form. The number of unit prices that may be included is not limited and additional sheets may be included if needed.

** If someone other than a corporate officer signs for the Bidder/Contractor, a copy of a corporate resolution or other signature authorization shall be required for submission of bid. Failure to include a copy of the appropriate signature authorization, if required, may result in the rejection of the bid unless bidder has complied with La. R.S. 38:2212(A)(1)(c) or RS 38:2212(O) .

BID SECURITY in the form of a bid bond, certified check or cashier's check as prescribed by LA RS 38:2218.A is attached to and made a part of this bid.

LOUISIANA UNIFORM PUBLIC WORK BID FORM

UNIT PRICE FORM

TO: St. John the Baptist Parish Council
1801 West Airline Hwy.
LaPlace, La 70068

(Owner to provide name and address of owner)

BID FOR: St. John the Baptist Parish
West Bank Safety Complex
5739 Highway 18
Edgard, La 70049
(*Owner to provide name of project and other identifying information)*

UNIT PRICES: This form shall be used for any and all work required by the Bidding Documents and described as unit prices. Amounts shall be stated in figures and only in figures.

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*

Wording for "DESCRIPTION" is to be provided by the Owner.
All quantities are estimated. The contractor will be paid based upon actual quantities as verified by the Owner

BID BOND

FOR

St. John the Baptist Parish Essential Services Safe Room

Date: _____

KNOW ALL MEN BY THESE PRESENTS:

That_____of_____, as Principal, and_____, as Surety, are held and firmly bound unto the State of Louisiana, Division of Administration, Office of Facility Planning and Control (Obligee), in the full and just sum of five (5%) percent of the total amount of this proposal, including all alternates, lawful money of the United States, for payment of which sum, well and truly be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents.

Surety represents that it is listed on the current U. S. Department of the Treasury Financial Management Service list of approved bonding companies as approved for an amount equal to or greater that the amount for which it obligates itself in this instrument or that it is a Louisiana domiciled insurance company with at least an A - rating in the latest printing of the A. M. Best's Key Rating Guide. If surety qualifies by virtue of its Best's listing, the Bond amount may not exceed ten percent of policyholders' surplus as shown in the latest A. M. Best's Key Rating Guide.

Surety further represents that it is licensed to do business in the State of Louisiana and that this Bond is signed by surety's agent or attorney-in-fact. This Bid Bond is accompanied by appropriate power of attorney.

THE CONDITION OF THIS OBLIGATION IS SUCH that, whereas said Principal is herewith submitting its proposal to the Obligee on a Contract for:

_____

NOW, THEREFORE, if the said Contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter into the Contract in writing and give a good and sufficient bond to secure the performance of the terms and conditions of the Contract with surety acceptable to the Obligee, then this obligation shall be void; otherwise this obligation shall become due and payable.

_____	_____
PRINCIPAL (BIDDER)	SURETY
BY: _____	BY:_____
AUTHORIZED OFFICER-OWNER-PARTNER	AGENT OR ATTORNEY-IN-FACT(SEAL)

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SECTION 00 4393

BID SUBMITTAL CHECKLIST

NOTE: FAILURE TO PERFORM ANY ONE OF THE ACTIONS LISTED ON THIS CHECKLIST MAY CAUSE BID TO BE REJECTED AS UNRESPONSIVE.

- ❑ Enclose Bid Security of not less than 5% of total Bid in the form of certified check, cashiers check, or bid bond. Bid bond must have attached appropriate and satisfactory power of attorney and be in compliance with LSA R.S 38:2218. Enclose **"Bid Bond"** in Bid envelope.

- ❑ Attach satisfactory evidence of authority of person signing on behalf of the individual, firm, partnership, or corporation. Enclose **"Document 00 4510 - Evidence of Agency, Corporate, or Partnership Authority"** in Bid envelope.

- ❑ If BIDDER is a corporation, evidence of authority must be in the form of a Corporate Resolution. Enclose **"Document 00 4543 - Corporate Resolution"** in Bid envelope.

- ❑ Enclose **"Document 00 4519 – Non-collusion Affidavit"**, signed, notarized and provided 10 days after the bid due date.

- ❑ Enclose "Attestations", signed and provided 10 days after the bid due date.

- ❑ Your bid must be submitted as duplicate originals in an opaque envelope. Any discrepancies between the duplicate originals will cause your Bid to be rejected.

- ❑ Your Louisiana State Contractor's License number must be shown on outside of Bid envelope and on the Bid Form.

- ❑ Bidder's name, return address, sealed bid proposal number and the Project name must appear on outside of Bid envelope.

- ❑ Check terms, delivery, starting, and completion times.

END OF SECTION

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DOCUMENT 00 4510

EVIDENCE OF AGENCY, CORPORATE, OR PARTNERSHIP AUTHORITY

A. Evidence of Agency, Corporate, or Partnership Authority: The Evidence of Agency, Corporate, or Partnership Authority document to be used for this Contract for Construction shall be provided by the Parish of St. John the Baptist and is bound in this Project Manual following this page.

END OF DOCUMENT

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EVIDENCE OF AGENCY, CORPORATE, OR PARTNERSHIP AUTHORITY

IMPORTANT NOTICE TO ALL BIDDERS

Current and original evidence of Agency, Corporate, or Partnership Authority is required for submission of a bid to the Parish of St. John the Baptist. Each Bidder must complete the following and submit along with bid.

FAILURE TO COMPLY WILL RESULT IN REJECTION OF YOUR BID.

The Bidder is:
1. Sole Proprietorship
2. Corporation
3. Partnership
4. Other, please specify _____

If you are a sole proprietorship the signature on the bid must be that of the Owner or the Owner must provide evidence of agency authorizing person to sign bid and obligate Owner.

If Bidder is a corporation, partnership or other legal entity bidder must comply with LSA-R.S. 38:2212.O.

LSA R.S. 38:2212.O reads as follows:
Whenever evidence of agency, corporate, or partnership authority is required for submission of a bid to a public entity, such fact shall be contained in the bid documents and such proof shall be provided in accordance with the provisions of this Section. The authority of the signature of the person submitting the bid shall be deemed sufficient and acceptable if any of the following conditions are met:

(1) The signature on the bid is that of any corporate officer listed on the most current annual report on file with the Secretary of State, or the signature on the bid is that of any member of a partnership or partnership in commendam listed in the most current partnership records on file with the Secretary of State.

(2) The signature on the bid is that of an authorized representative of the corporation, partnership, or other legal entity and the bid is accompanied by a corporate resolution, certification as to the corporate principal, or other documents indicating authority which are acceptable to the public entity.

(3) The corporation, partnership, or other legal entity has filed in the appropriate records of the Secretary of State or the Clerk of Court for the Parish in which the public entity is located, an affidavit, resolution or other acknowledged or authentic document indicating the names of all parties authorized to submit bids for public contracts. Such document on file with the Secretary of State or the Clerk of Court shall remain in effect and shall be binding upon the principal until specifically rescinded and canceled from the records of the respective offices.

I have read and do understand the above.

_____
(Signature of Bidder)

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DOCUMENT 00 4519

NON-COLLUSION AFFIDAVIT

A. Non-Collusion Affidavit: The Non-Collusion Affidavit document to be used for this Contract for Construction shall be provided by the Parish of St. John the Baptist and is bound in this Project Manual following this page.

END OF DOCUMENT

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NON-COLLUSION AFFIDAVIT

STATE OF LOUISIANA
ST JOHN THE BAPTIST PARISH

BEFORE ME, the undersigned authority, personally came and appeared_____

_____ , who after being by me duly sworn,

deposed and said that he is the fully authorized _____

of _____

(hereinafter referred to as Bidder) the party who submitted a bid to perform all work for construction of the **ST. JOHN THE BAPTIST PARISH, Westbank Public Safety Complex, 5739 Highway 18, Edgard, Louisiana**, **70049**, which Bid was received by St. John the Baptist Parish on _____, 20_____ and said affiant further said:

(1) That Bidder employed no person, corporation, firm, association, or other organization, either directly or indirectly, to secure the public contract under which he received payment, other than persons regularly employed by the Bidder whose services in connection with the construction of the public building or project or in securing the public contract were in the regular course of their duties for Bidder; and
(2) That no part of the contract price received by Bidder was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the contract, other than the payment of their normal compensation to persons regularly employed by the Bidder whose services in connection with the construction of the public building or project were in the regular course of their duties for Bidder.
(3) Said bid is genuine and Bidder has not colluded, conspired or agreed directly or indirectly with any other Bidder to offer sham or collusive bid.
(4) Said Bidder has not in any manner directly or indirectly agreed with any other person to fix the bid price of affiant or any other Bidder, or to fix any overhead, profit or cost element of said bid price, or that of any other Bidder, or to induce any other person to refrain from bidding.
(5) Said Bidder is not intended to secure and unfair advantage or benefit from the Parish of Jefferson or in favor of any person interested in the proposed contract.
(6) All statements contained in said bid are true and correct.
(7) Neither affiant nor any member of his company has divulged information regarding said bid or any data relative thereto to any other person, firm or corporation.

_____

SWORN TO AND SUBSCRIBED BEFORE ME

THIS _____ DAY OF _____ 20____

_____
(Notary Public)

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DOCUMENT 00 4529

INSURANCE REQUIREMENTS

A. Insurance Requirements: The Insurance Requirements to be provided by the Contractor during the total term of Contract shall be as required by the Parish of St. John the Baptist and are as bound in the Project Manual following this page.

END OF DOCUMENT

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INSURANCE REQUIREMENTS

St. John the Baptist Parish Council

1801 West Airline Highway LaPlace, LA 70068

Contractor shall obtain, pay for and keep in force, at its own expense, minimum insurance effective in all localities where contractor may perform the work hereunder, with such carriers as shall be acceptable to Council:

A. **Statutory Workman's Compensation** covering all state and local requirements and Employer's Liability Insurance covering all persons employed by Contractor in connection with this agreement.

The limits for "A" above shall be not less than:

1. Employers liability limits of $1,000,000/$1,000,000/$1,000,000
2. Some contracts may require USL&H or maritime coverage. This should be checked out with Insurance Dept. /Legal Dept.
3. No excluded classes of owners/officers or employees shall be allowed on Council's premises

WAIVER OF SUBROGATION in favor of St. John the Baptist Parish Council shall be indicated on certificate

B. **Commercial General Liability**, including:

1. Contractual liability assumed by this agreement
2. Owners and Contractor's Protective Liability (if Contractor is a General Contractor) may be required
3. Personal and advertising liability
4. Completed operations
5. Medical payments

The limits for "B" above shall not be less than:

1. $1,000,000 each occurrence limit
2. $2,000,000 general aggregate limit
3. $1,000,000 products/completed operations aggregate limit
4. $1,000,000 personal and advertising injury limit
5. $50,000 fire damage limit
6. $5,000 medical expense limit (desirable but not mandatory)

St. John the Baptist Parish Council will be NAMED as additional insured and WAIVER OF SUBROGATION in favor of St. John the Baptist Parish Council shall be indicated on certificate. Some contracts may require Protection and Indemnity coverage. This should be checked out with Insurance Dept. /Legal Dept.

C. **Comprehensive Automobile Liability** covering all owned, hired and other non-owned vehicles of the Contractor.

The limits for "C" above shall not be less than:

1. $1,000,000 CSL

St. John the Baptist Parish Council will be NAMED as additional insured and WAIVER OF SUBROGATION in favor of St. John the Baptist Parish Council shall be included on certificate.

D. **Professional Liability Insurance** covering the Wrongful Acts of those professional firms and individuals performing services for SJBP.
Certain classifications of service providers will be required to provide evidence of Professional Liability Insurance. Examples of these providers include but are not limited to: Professional Engineers, Architects, Land Surveyors, Attorneys, and IT Consultants.
The limits for "D" above shall not be less than:
1. $1,000,000 CSL

WAIVER OF SUBROGATION in favor of St. John the Baptist Parish Council shall be included on the Certificate.

OTHER SPECIFIC COVERAGE RELATED TO THE TASK BEING PERFORMED MAY BE REQUIRED, i.e. Builders Risk, Installation Floater.

All required insurance certificates shall be submitted to the Director of Purchasing & Procurement prior to commencement of work. Vendor shall maintain insurance in full force and effect during the entire period of performance of work. All policies must have a thirty (30) day non-cancellation clause giving the Parish thirty (30) days prior written notice in the event a policy is changed or canceled.

CERTIFICATES

A W-9 form is to be furnished prior to work being issued.

When applicable, a current St. John the Baptist Parish Occupational License is to be maintained. Yearly, a copy of such license shall be provided to the Director of Purchasing

WHEN APPLICABLE, A CURRENT LOUISIANA STATE CONTRACTOR'S LICENSE SHOULD BE FURNISHED.

DOCUMENT 00 4543

CORPORATE RESOLUTION

A. Corporate Resolution: The Corporate Resolution Form to be used for this Contract for Construction shall be as provided by the Parish of St. John the Baptist and is bound in the Project Manual following this page.

END OF DOCUMENT

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CORPORATE RESOLUTION

EXCERPT FROM MINUTES OF THE BOARD OF DIRECTORS OF _____ _____ ,INCORPORATED. At the meeting of directors of _____ , Incorporated, duly noticed and held on _____ 20 _____, a quorum being there present, on motion duly made and seconded. It was:

RESOLVED. That _____ , be and is hereby appointed, constituted and designated as agent and attorney-in-fact of the Corporation with full power and authority to act on behalf of this Corporation in all negotiations, bidding, concerns and transactions with **St. John the Baptist Parish Council** or any of its agencies, departments, employees or agents, including but not limited to, the execution of all bids, papers, documents, affidavits, bonds, sureties, contracts and acts and to receive and receipt therefore all purchase orders and notices issued pursuant to the provisions of any such bid or contract, this Corporation hereby ratifying, approving, confirming and accepting each and every such act performed by the said agent and attorney-in-fact.

I hereby certify the foregoing to be a true and correct copy of an excerpt of the minutes of the above dated meeting of the Board of Directors of said Corporation, and the same has not been revoked or rescinded.

_____
(Secretary-treasurer)

_____ 20_____
(Date)

(This form or other document which establishes Evidence of Agency in accordance with LA R.S. 38:2212 et seq. shall be included in Bid Envelope)

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DOCUMENT 00 4549

ATTESTATIONS AFFIDAVITS

A. Attestations Affidavits: The Attestations Affidavits to be used for this Contract for Construction shall be as provided by the Parish of St. John the Baptist and are bound in this Project Manual following this page.

END OF DOCUMENT

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Hold Harmless

To the fullest extent permitted by law, Company/Consultant shall indemnify, hold harmless, and defend the Parish Council and all of its Agents and Employees, from and against all claims, damages, losses and expenses, including but not limited to attorney's 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) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of Company.

Non-assignability

No Company/Consultant shall assign any interest in this contract by assignment, transfer, or novation, without prior written consent of the Parish. This provision shall not be construed to prohibit the contractor from assigning his bank, trust company, or other financial institution any money due or to become due from approved contracts without such prior written consent. Notice of any such assignment or transfer shall be furnished promptly to the Parish.

Exclusions

Pursuant to Louisiana Revised Statute 38:2227, Company must certify that he has not been convicted of, or has not entered into a plea of guilty or nolo contendere to public bribery, corrupt influencing, extortion, money laundering or their equivalent Federal crimes. Consultant must further certify that he has not been convicted of, or has not entered into a plea of guilty or nolo contendere to theft, identify theft, theft of a business record, false accounting, issuing worthless checks, bank fraud, forgery, contractors' misapplication of payments, malfeasance in office, or their equivalent Federal crimes within the five (5) years prior to submitting the proposal.

Disclosure

Company/Consultant must disclose whether it provides services or pays commissions to any employee or elected official of St. John the Baptist Parish. If so, company must disclose to whom services are provided and/or commissions are paid. Both positive and negative responses must be submitted.

E-Verify Program

Pursuant to Louisiana Revised Statute 38:2212.10, contractor must certify that it and each individual, firm or corporation associated with it and engaged in the physical performance of services in the State of Louisiana, under a contract with St. John the Baptist Parish has registered with, is participating in, and shall continue to participate in a federal work authorization program designated as such under the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, as amended, which is operated by the United States Department of Homeland Security, known as the "E-Verify" program. Contractor must verify the legal status of all existing and new employees in the State of Louisiana by attesting herein that each is a citizen of the United States or legal aliens as defined by now effective immigration laws of the United States of America.

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E-VERIFY AFFIDAVIT

STATE OF LOUISIANA

PARISH OF _____

BEFORE ME, the undersigned Notary Public PERSONALLY CAME AND APPEARED,

I, _____, the owner/authorized representative of

_____
Company/Individual/Legal Entity Name

who hereby personally and as the authorized representative of the above identified legal person executes this affidavit, as the undersigned Contractor verification of its current and future compliance with L.S.A. R.S. 38:2212.10, stating affirmatively that it and each individual, firm or corporation associated with it and engaged in the physical performance of services in the State of Louisiana, under a contract with St. John the Baptist Parish has registered with, is participating in, and shall continue to participate in a federal work authorization program designated as such under the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, as amended, which is operated by the United States Department of Homeland Security, known as the "E-Verify" program. The Contractor hereby verifies the legal status of all existing and new employees in the State of Louisiana by attesting herein that each is a citizen of the United States or legal aliens as defined by now effective immigration laws of the United States of America.

Contractor shall not assign this Contract or any monies due or to become due hereunder, or subcontract any part of the Work without the prior written consent of St. John the Baptist Parish.

Contractor verifies that Contractor will collect an affidavit in this form from any approved subcontractor and forward a copy to: St. John the Baptist Parish, 1801 West Airline Hwy, LaPlace, Louisiana 70068, no later than five business days of contracting with its subcontractor; however, in no instance shall the affidavit be received after commencement of work by the subcontractor.

_____
Signature of Authorized Signatory

_____
Date E-Verify ID Assigned

_____
Printed Name of Signatory

_____
E-Verify ID

_____
Title of Authorized Signatory

SUBSCRIBED AND SWORN BEFORE ME ON THIS THE DAY OF_____ , 20_____

_____
Notary Signature

Printed Notary Name: _____

Notary/Bar Roll Number: _____

My Commission is For/Expires: _____

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PAST CRIMINAL CONVICTIONS OF BIDDERS ATTESTATION (LA. R.S. 38:2227)

STATE OF LOUISIANA

PARISH OF _____

BEFORE ME, the undersigned Notary Public PERSONALLY CAME AND APPEARED,

I, _____, (Appearer) the owner/authorized representative of

_____
Company / Individual / Legal Entity Name

Appearer, as a Bidder on the herein named Project, does hereby attest that:

A. No sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named herein, including any silent or dormant owner or manager, has been convicted of, or has entered a plea of guilty or nolo contendere to, any of the following state crimes or equivalent federal crimes:

(a) Public bribery (R.S. 14:118)
(b) Corrupt influencing (R.S. 14:120)
(c) Extortion (R.S. 14:66)
(d) Money laundering (R.S. 14:230)

B. For five years prior to the project bid date, no sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named herein, including any silent or dormant owner or manager, has been convicted of, or has entered a plea of guilty or nolo contendere to any of the following state crimes or equivalent federal crimes, during the solicitation or execution of a contract or bid awarded pursuant to the provisions of Chapter 10 of Title 38 of the Louisiana Revised Statutes:

(a) Theft (R.S. 14:67)
(b) Identity Theft (R.S. 14:67.16)
(c) Theft of a business record (R.S. 14:67.20)
(d) False accounting (R.S. 14:70)
(e) Contractor's misapplication of payments (R.S. 14:202)
(f) Bank fraud (R.S. 14:71.1)
(g) Forgery (R.S. 14:72)
(h) Issuing worthless checks (R.S.14:71)
(i) Malfeasance in office (R.S. 14:134)

_____
Name of Bidder

_____
Signature of Authorized Signatory of Bidder

_____
Project Name/Number

_____
Title of Authorized Signatory

SUBSCRIBED AND SWORN BEFORE ME ON THIS _____ DAY OF_____, 20_____.

_____
Notary Signature

Printed Notary Name: _____

Notary/Bar Roll Number: _____

My Commission is For/Expires: _____

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SAINT JOHN THE BAPTIST PARISH
NON-SOLICITATION AND UNEMPLOYMENT AFFIDAVIT
(Pursuant to La. R.S. 38:2224 and La. R.S. 23:1726(B))

STATE OF _____

PARISH/COUNTY OF_____

Before me, the undersigned authority, came and appeared,

I, _____, the owner/authorized representative of

_____
Company/Individual/Legal Entity Name

who, being first duly sworn, deposed and state that I personally and as an authorized representative of the above identified legal person executes this continuing affidavit stating that neither the above named Contractor nor a person acting on its behalf, either directly or indirectly, employed, paid, nor promised <u>any</u> gift, consideration or commission to any person or legal entity to procure or assist in procuring this public contract, other than persons regularly employed by Contractor whose services were in the regular course of their duties for Contractor in connection with the construction, alteration or demolition of a public building or project.

The above named Contractor, if awarded, continually affirms that no part of the contract price received by Contractor was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the contract, other than the payment of their normal compensation to persons regularly employed by the affiant whose services were in the regular course of their duties for Contractor.

The above named Contractor hereby attests and certifies that it does not have any unpaid assessment or penalty levied against it regarding unemployment compensation and currently does and will continue to properly classify each employee.
Contractor verifies that Contractor will collect an affidavit in this form from any approved subcontractor and forward a copy to: Saint John the Baptist Parish, 1801 West Airline Hwy, LaPlace, Louisiana 70068, no later than five business days after contracting with its subcontractor; however, in no instance shall the affidavit be received after commencement of work by the subcontractor.

_____ Signature of Authorized Signatory _____ Printed Name of Signatory _____ Title of Authorized Signatory _____ Project Name/Number	SUBSCRIBED AND SWORN BEFORE ME ON THIS _____ DAY OF _____2012. _____ Notary Signature Printed Notary Name: _____ Notary/Bar Roll Number: _____ My Commission is for/expires on: _____

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CONTRACTING REQUIREMENTS

Sizeler Thompson Brown Architects
300 Lafayette Street, Suite 200
New Orleans, LA 70130
Phone: 504-523-6472
Fax: 504-529-1181

www.sizelerthompsonbrown.com

AIA® Document A101™ – 2007

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

AGREEMENT made as of the _____ day of _____ in the year Two Thousand Sixteen
(In words, indicate day, month and year)

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

St. John the Baptist Parish Library Board
2920 Highway 51
LaPlace, LA 70068

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

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

Roland Borne Memorial Library Expansion
St. John the Baptist Parish
2979 LA Highway 18
Edgard, LA 70049

A renovation and addition to the existing Roland Borne Memorial Library located in Edgard, Louisiana

The Architect:
(Name, address and other information)

Sizeler Thompson Brown Architects
Regional Design Group, LLC
300 Lafayette Street, Suite 200
New Orleans, LA 70130

The Owner and Contractor agree as follows.

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

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

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Init.
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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

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8 MISCELLANEOUS PROVISIONS

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10 INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

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

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than Two Hundred Forty (240) days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Init.

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User Notes: (1311995715)

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

The Owner shall assess or the Contractor shall pay to Owner liquidated damages of five hundred dollars ($500.00) per calendar day that Contractor fails to achieve substantial completion in compliance with the Contract Time.

If Contractor/Bidder fails to complete all punch list items within 45 days from the date that the project is certified as substantially complete, the Owner may deduct from the remaining contract balance the sum of seven hundred fifty dollars ($750.00) per calendar day as liquidated damages for each calendar day thereafter until all punch list items are complete.

ARTICLE 4 CONTRACT SUM

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

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

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

Item	Units and Limitations	Price Per Unit

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

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

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

The 26th day of the month to the 25th day of the following month.

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 26th day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the 10th day of the next month. If an Application for Payment is received by the Architect after the application date fixed above, payment

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shall be made by the Owner not later than Twenty (20) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

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

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

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of five percent (5%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of five percent (5%);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

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

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

None permitted.

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

§ 5.2 FINAL PAYMENT

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

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

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

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

Final payment is conditioned upon complying with the requirements set forth in the General Conditions of the Contract for Construction.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[X] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

per annum

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

§ 8.4 The Contractor's representative:

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(Name, address and other information)

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

§ 8.6 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

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

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

(Table deleted)
§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

(Table deleted)
§ 9.1.6 The Addenda, if any:

Number	Date	Pages

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

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

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract

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Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	**Limit of liability or bond amount ($ 0.00)**
See General Conditions	See General Conditions

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

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

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DOCUMENT 00 6113

PERFORMANCE BOND AND PAYMENT BOND FORMS

A. Performance Bond: The Performance Bond and Payment Bond Forms to be used for this Contract for Construction shall be **A.I.A. Document A312 - PERFORMANCE BOND AND PAYMENT BOND - 2010 Edition** and is available for review at the office of the Architect.

END OF DOCUMENT

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AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
21238.00 - St. John The Baptist Parish
West Bank Public Safety Complex
Wallace, LA

THE OWNER:
(Name, legal status and address)
St. John the Baptist Parish
1801 W. Airline Highway
LaPlace, LA 70068

THE ARCHITECT:
(Name, legal status and address)
Sizeler Thompson Brown Architects
Regional Design Group, LLC
300 Lafayette Street, Suite 200
New Orleans, LA 70130

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

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

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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, the Contractor's bid or portions of Addenda relating to bidding 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.

(Paragraphs deleted)

§ 1.1.8 THE PROJECT MANUAL

Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications. The Sections in Division 1 – General Requirements specify detailed administrative and procedural requirements, which are applicable to all elements of the Construction Contract. The following documents are applicable to Division 1 – General Requirements:

.1 Drawings.

.2 Bidding Requirements (will be included as part of the Contract Documents in the Owner/Contractor Agreement).

.3 Owner/Contractor Agreement.

.4 Bonds.

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.5 General Conditions.
.6 Supplementary Conditions.
.7 Specification Divisions 2 through 16

§ 1.1.9 MISCELLANEOUS DEFINITIONS

§ 1.1.9.1 Terms "building code," and "code," refer to regulations of governmental entities having jurisdiction over the Project and the Work.

§ 1.1.9.2 "Acceptable," "required," and "as directed" refer to or indicate work or materials that may be acceptable or approved by the Architect, as the Owner's representative during the construction phase, only to the extent the work or materials conform to the requirements of the Contract Documents and in no way shall be interpreted to imply any responsibility on the part of the Architect concerning the Contractor's obligations under the requirements of the Contract Documents.

§ 1.1.9.3 Term "similar" means in its general sense and not necessarily identical.

§ 1.1.9.4 Terms "shown," "indicated," "detailed," "noted," "scheduled," and terms of similar import, refer to requirements contained in Contract Documents.

§ 1.1.9.5 "Defective work" includes but is not limited to movable or adjustable work which has not remained in good working order including hardware, weatherstripping, doors, windows, drawers, apparatus, machinery and electrical and mechanical equipment, except for normal wear.

§ 1.1.9.6 The term Knowledge, recognize and discover, their respective derivatives, and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor know, recognizes and discovers in exercising appropriately and in accordance with industry standards, the care, skill and diligence required by the Contract Documents. Analogously, the expression reasonably inferable and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a Contractor familiar with the Project and exercising the care, skill and diligence required of the Contractor by the Contract Documents.

§ 1.1.9.7 When the word "provide" including derivatives thereof is used, it shall mean to properly fabricate, transport, deliver, install, erect, construct, test and furnish all labor, materials, equipment and related items necessary to complete the Work as required by the Contract Documents.

§ 1.1.9.8 The term "persistently" and other similar expressions, as used in reference to the Contractor, shall be interpreted to mean any combination of material acts and omissions, which causes the Owner or the Architect to reasonably conclude that the Contractor will not complete the Work within the Contract Time, for the Contract Sum or in substantial compliance with the requirements of the Contract Documents.

§ 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.

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

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

§ 1.2.4 In the case of an inconsistencies within or between portions of the Contract Documents, the Contractor shall (1) provide the better quality or greater quantity of Work; or (2) comply with the more stringent requirements, either or both in accordance with the Architect's interpretation. The terms and conditions of the §1.2.4 however,

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shall not relieve the Contractor of any of the obligations set forth in Paragraph 3.2, or any other provisions of the Contract Documents.

§ 1.2.4.1 In connection with the Drawings, specified dimensions shall take precedence over scaled measurements and large scale drawings take precedence over small scale drawings.

§ 1.2.4.2 Before ordering any materials or performing any Work, the Contractor and each Subcontractor shall verify measurements at the Project Site and shall be responsible for the correctness of such measurements. No additional compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference between field measurements and dimensions set out in the Contract Documents shall be submitted to the Architect for resolution before proceeding with the Work.

§ 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 will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this 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 material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

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 to Architect and Contractor a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Any changes in the designation of a representative shall be made in writing. 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.

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§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

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

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

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

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

§ 2.2.5 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.

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

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

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 written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

§ 2.5 EXTENT OF OWNER RIGHTS

§ 2.5.1 The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limiation of any right of the Owner granted in the Contract Documents, at law or in equity.

§ 2.5.2 In no event will the Owner have control over, charge of or any responsibility for construction means, methods, techniques, services, or procedures or for safety precautions and programs in connections with the Work, notwithstanding any rights and authority granted the Owner in the Contract Documents.

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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 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. The Contractor and each Subcontractor have evaluated and satisfied themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation (1) the location, condition, layout and nature of the Project site and surrounding areas; (2) the prevailing climatic conditions; (3) anticipated labor supply and costs; (4) availability and cost of materials, tools and equipment; and (5) other similar issues which in any way may affect the cost or time for performing the Work. The Owner assumes no responsibility or liability for the safety of the Project. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time in connection with any failure by the Contractor or any Subcontractor to comply with the requirements of the Contract Documents.

§ 3.2.1.1 After notifying the Architect, in writing, of any error, inconsistency, or omission discovered in the Contract Documents, the Contractor shall not proceed with any Work so affected without Architect's written interpretation and decision.

§ 3.2.1.2 The Architect shall have the final authority to determine whether any change or modification should be made, and no change or modification of any kind shall be made except on the Architect's written instructions.

§ 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 2.2.3, 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. The Contractor shall satisfy itself as to the accuracy of all grades, elevations, dimensions and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work which is apparent from a reasonable inspection. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner or adjustment to the Contract Time.

§ 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

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3.2.3, the Contractor shall make 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 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 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. Further, the Contractor shall be fully and solely responsible for the jobsite safety.

§ 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.
§ 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 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.

(Paragraph deleted)
§ 3.4.3 The products specified or indicated on the Drawings or in the Specifications are used only to denote the quality standard of product desired. The term "equal" or "or equal", used in the Specifications is defined as meaning "equal in the professional judgment of the Architect." Approval of other products or requests for substitution shall be at the Architect's discretion and in accordance with provisions of the Bidding Requirements or General Requirements of the Specifications.
§ 3.4.4 A request made by the Contractor for a substitution is a representation to the Architect as follows:

.1 The Contractor has investigated the proposed substitute and determined that it is equal or superior in all respects to that specified.
.2 The Contractor will provide the same warranty for the substitute product as for that specified.
.3 The Contractor will coordinate the installation of the accepted substitute, making such changes as may be required to complete the Work in all respects.

§ 3.5 WARRANTY

The Contractor warrants to the Owner that the materials and the equipment furnished under the Contract will be new unless otherwise required or permitted by the Contract Documents, and that the Work will be free from defects not inherent in the quality required or permitted and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved, will be considered non-conforming. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.1 All warranties shall take effect on the date of Substantial Completion of the Work or designated portion thereof which includes the items covered by warranties, not on the date of installation of any specific product.

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§ 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.

§ 3.6.1 Taxes include, without limitation, Old Age Pension, Unemployment and any other and all taxes imposed by local, City, Parish, or the Federal Government and include such expenses or taxes as a part of the stipulated Contract sum.

§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS
§ 3.7.1 Except as set forth in Paragraph 2.2.2, the Contractor shall include in the Contract Sum and secure, pay for, and, as soon as practicable, furnish the Owner with copies or certificates of all permits including, without limitation, all building permits as required by governmental authorities having jurisdiction over the Project, and fees, licenses, and inspections necessary for the proper execution and completion of the Work. All construction charges, assessments, or inspection fees as may be imposed by any municipal agency or utility company are included in the Contract Sum and are the Contractor's responsibility.

§ 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.

§ 3.7.3.1 The Contractor, at his own expense, shall record , prior to commencement of the Work, a Notice of Contract and required performance and payment bonds with the Clerk of Court or Recorder of Mortgages of the Parish where the Work is to be performed. Contractor shall furnish the Architect and Owner with all recordation information, including date, time, book and folio number.

§ 3.7.4 Concealed or Unknown Conditions. Contractor represents that it has investigated the site and is familiar with all known, apparent, or reasonably discoverable conditions, subsurface or otherwise, which will be encountered at the site, and that Contractor has taken those conditions into account in establishing the Contract Sum and the Contract Time, as well as all other conditions concerning the performance of the Work, including without limitation, underground and above ground utilities, work space restrictions, work hour restrictions, noise restrictions, restrictions on site ingress and egress, weather conditions, ground water, dewatering requirements, temporary and permanent utilities relocation, ventilation requirements, and all other restrictions, demands, and requirements needed for the timely and adequate performance of the Work required by the Contract Documents, and all such conditions have been assumed by Contractor and our reflected and incorporated into the Contract Sum and the Contract Time, Subject to the foregoing, 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 21 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 an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed 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

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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 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 furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply 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 SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor shall include identification of the critical path, i.e. where any delay in the completion of these tasks will lengthen the Project's completion, unless appropriate action is taken.

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

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

§ 3.10.4 In the event the Architect determines that the performance of the Work has not progressed or reached the level of completion required by the Contract Documents, the Owner, upon the recommendation of the Architect,

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shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of the construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities, and (3) other similar measures (hereinafter referred to as "Recovery Measures"). Such Recovery measures shall continue until the progress of the Work achieves the stage of completion required by the Contract Documents. The Owner's right to require Recovery Measure is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

§ 3.10.4.1 The Contractor shall not be entitled to an adjustment in the Contract Sum in connection with Recovery Measures required by the Owner under or pursuant to this Paragraph 1.10.4 unless the Recovery Measures were directed by the Owner to recover from delays for which the Contractor was entitled to an extension of the Contract Time pursuant to the Contract Documents, and said extension of time was timely and properly requested by Contractor and improperly denied by Owner.

§ 3.10.4.2 The Owner may exercise the rights provided the Owner under pursuant to this Paragraph 3.10.4 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with the completion date set forth in the Contract Documents.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

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

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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

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§ 3.12.7.1 Failure by the Contractor to submit Shop Drawings shall be at the Contractor's sole risk and may result in rejection of any completed or partially completed Work (by the Architect.)

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional and who shall comply with reasonable requirements of the Owner regarding qualifications and insurance. 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 shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Architect has specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the purpose of checking for conformance with information given and the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.12.11 Additional information and procedures for handling Shop Drawings, Product Data and Samples is specified in the General Requirements (Division 1 of the Specifications).

§ 3.13 USE OF SITE

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

§ 3.13.1 The Owner shall have the right to use any and all portions of the site and the Work in accordance with Article 6, provided that such occupancy does not hamper the Contractor or prevent his efficient completion of the Work. Such use shall not constitute an acceptance of the Contractor's work in whole or in part.

§ 3.14 CUTTING AND PATCHING

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

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably

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withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.14.3 Additional information and procedures for Cutting and Patching is specified in the General Requirements (Division 1 of the Specifications).

§ 3.15 CLEANING UP

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

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

§ 3.15.3 Additional information and procedures for Cleaning Up is specified in the General Requirements (Division 1 of the Specifications).

§ 3.16 ACCESS TO WORK

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

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law 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 but only to the extent caused by the negligent acts or omissions or breach of contract of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 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.

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§ **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, and Architect. Consent shall not be unreasonably withheld.

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

§ 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, except as provided in Section 3.3.1.

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

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

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

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

§ **4.2.6** The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ **4.2.7** The Architect will review 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

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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 authorize 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 duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents. There will be no restriction on the Owner having a representative.

§ 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 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.

(Paragraph deleted)

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 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, at the pre-construction conference, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. No payments will be due and payable to the Contractor until the Contractor submits the information required in this Section.

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§ 5.2.2 The Contractor shall be solely responsible for selection and performance of all Subcontractor and suppliers The Contractor shall not be entitled to an increase in the Contract Time or the Contract Sum due to a problem with performance or non-performance of a Subcontractor or supplier.

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

(Paragraphs deleted)

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

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

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 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 not be legally responsible for all of the successor contractor's obligations under the subcontract.

(Paragraph deleted)

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

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

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

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

§ 6.2 MUTUAL RESPONSIBILITY

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable

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for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The 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 the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors 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, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work. Except as permitted in Section 7.3 and Paragraph 9.7.2, a change in the Contract Sum or the Contract Time may be accomplished only by Change Order or by a Construction Change Directive signed by the Owner's representative. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance or alterations or additions to the Work and no claim that Owner has been unjustly enriched by any alteration of or addition to the Work, whether or not there is, in fact, any unjust enrichment to the Owner, shall be the basis of any claim for an increase in the amount due under the Contract Documents or a change in the Contract Time or any time period provided for in the Contract Documents.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written order to the Contractor signed by the Owner and the Architect, issued after execution of the Contract, authorizing a change in the work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time.

§ 7.2.2 "Cost of the Work" for the purchase of Change Orders shall be costs required to be incurred in performance of the Work and paid by the Contractor and Subcontractor which shall consist of:

1. Wages paid to direct labor personnel, delineating a labor burden markup for applicable payroll taxes, worker's compensation insurance, unemployment compensation, and social security taxes.
2. Cost of all materials and supplies, including the identification of each item and its cost.
3. Reasonable rental rates for machinery and equipment.
4. Other documented direct costs.

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§ 7.2.3 "Overhead and profit" The Contractor and Subcontractor shall be due job-site and home office fixed overhead and profits on the Cost of the Work, but shall not exceed a total of 18% of the direct cost of any portion of Work, as specifically set out in 7.3.11.

§ 7.2.4 The credit to the Owner resulting from a change in the Work shall be the sum of those items above, except credit will not be required for overhead and profit. Where a change results in both credits to the Owner and extras to the Contractor for related items, overhead and profit will only be computed on the net extra cost to the Contractor. § 7.2.4 After a Change Order has been approved, no future requests for extensions of time or additional cost shall be considered or recoverable for that Change Order work.

§ 7.2.5 The Contractor will be due extended fixed job-site overhead for time delays only when complete stoppage of work occurs causing a contract completion extension and the Contractor is unable to mitigate financial damages through replacement work. The stoppage must be due to acts or omissions solely attributable to the Owner. In all cases the Contractor is to notify the Architect in writing as required in Article 15. Reasonable proof may be required by the Architect that alternate work could not be performed. Reasonable proof may be required by the Architect that the stoppage adversely affected the date of Substantial Completion.

§ 7.2.6 Cost of Work whether General Contract cost or SubContract cost shall not apply to the following:

1. Salaries or other compensation of the Contractor's personnel at the Contractor's principal office and branch offices not specifically charged to the project.
2. Any part of the Contractor's capital expenses, including interest on the Contractor's capital employed for the work.
3. Overhead and general expenses of any kind or the cost of any item not specifically and expressly included above in Cost of the Work.
4. Cost of supervision not specifically required by the Change Order unless said change order extends the project duration.

§ 7.2.7 When applicable as provided by the Contract, the cost to Owner for Change Orders shall be determined by quantities and unit prices. The quantity of any item shall be as submitted by the Contractor and approved by the Architect. Unit prices shall cover cost of Material, Labor, Equipment, Overhead and Profit.

§ 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; calculated in accordance with § 7.2, but not to exceed a specified amount; or
.4 As provided in Section 7.3.7.

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

§ 7.3.5 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,

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provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 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.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in Section 7.2. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- **.1** Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- **.2** Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- **.3** Rental costs of machinery and equipment,
- **.4** Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- **.5** Other documented direct costs of the Work.

§ 7.3.7.1 "Cost of the Work" whether General Contract cost or Subcontract cost shall not apply to the following:

- .1 Salaries or other compensation of the Contractor's personnel at the Contractor's principal office and branch offices.
- .2 Any part of the Contractor's capital expenses, including interest on the Contractor's capital employed for the work.
- .3 Overhead and general expenses of any kind or the cost of any item not specifically and expressly included above in cost of the Work.
- .4 Cost of supervision not specifically required by the 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.

§ 7.3.11 An allowance for the combined overhead and profit for Change Orders and Construction Change Directives included in the total cost to the Owner shall be based on the following schedule:

- .1 For the Contractor, for work performed by the Contractor's own forces, 10 percent of the cost.
- .2 For the Contractor, for work performed by the Contractor's Subcontractor, 8 percent of the amount due the Subcontractor.
- .3 For each Subcontractor or Sub-subcontractor, for work performed by that Subcontractor's or Sub-subcontractor's own force, 10 percent of the cost.
- .4 For each Subcontractor, for work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.

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.5 Cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.6.

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

.7 Overhead and profit shall not exceed a total of 18% of the direct cost of any portion of the work.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

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 Contract Time shall be based on Consecutive Calendar Days (Weekdays, Saturdays, Sundays and Holidays inclusive). A Calendar Day is one of 24 hours beginning at 12:00 midnight.

§ 8.1.5 Contractor shall commence work under this Contract on date specified in the Notice To Proceed and fully complete the Work of the Project within number of Consecutive Calendar Days (Weekdays, Saturdays, Sundays and Holidays included) stated in the Agreement. The Contract Time shall not be changed by the Contractor's submission of a schedule which shows a completion date earlier than the Contract completion date, unless specifically authorized by Change Order.

§ 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. The Contractor agrees to commence work not later than five (5) days, unless noted otherwise, after the transmittal date of a written notice to proceed from the Owner or the issuance of the building permit, whichever is later and to substantially complete the project within the Contract Time. The Owner will suffer financial loss if the project is not substantially complete in the time set forth in the Contract Documents. The Contractor and the Contractor's surety shall be liable for and shall pay to the Owner the sum stated in the Contract Documents as fixed, agreed upon liquidated damages for each consecutive calendar day (Saturdays, Sundays and holidays included) of delay until the work is substantially complete. Such Liquidated Damages shall be withheld by the Owner from the amounts due the Contractor for progress and/or final payments.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by fire, unavoidable casualties or other causes beyond the Contractor's control; or

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by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may recommend, subject to Owner's approval. If the claim is not made within the time limits set out in Article 15, all right for future claims for that month are waived.

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

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

§ 8.3.4 If the Contractor submits a schedule or a progress report indicating, or which otherwise expresses an intention to achieve, completion of the Work prior to any completion date required by the Contract Documents or the expiration of the Contract Time, the Owner will not be liable to the Contractor for any failure of the Contractor to so complete the Work by such date or time.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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.

§ 9.2 SCHEDULE OF VALUES

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

§ 9.2.2 In general, the Contract Sum shall be distributed in accordance with the type of work designated by the Technical Sections of the Specifications with one additional line item for the value of jobsite overhead. In the case of large projects sections shall be subdivided further into component parts of the Technical Sections as the Architect determines.

§ 9.2.3 All line items shall be composed of a base dollar value to which shall be added a dollar value for home office overhead and a dollar value for profit.

§ 9.2.4 Total of all items shall be equal to total Contract Sum. This schedule, when approved by Architect, will be used as the only basis for contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 Monthly, the Contractor shall submit to the Architect an Application & Certificate for Payment on the AIA Document G702-1992, accompanied by AIA Document G703-1992, and supported by any additional data substantiating the Contractor's right to payment as the Owner or the Architect may require. One original copy shall be signed and notarized. Provide amount of copies as indicated in Division 1 of the Specification. An Application for Payment shall be submitted on or about the first of each month for the value of labor and materials incorporated into the work and of materials, suitably stored, at the site as of the twenty-fifth day of the preceding month, less normal retainage, as set out below:

§ 9.3.1.1 Retainage shall be 10% of the Contract Sum; except that on any public works contract of $500,000 or more, the amount retained shall not exceed 5% of the Contract Sum.

§ 9.3.1.2 Each Application for Payment shall be accompanied by the following, all in the form and substance satisfactory to the Owner:

1. A current Contractor's claim and lien waiver duly executed and an acknowledged sworn statement showing that all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts or purchase orders, the amount of each such subcontract or purchase order, the amount requested for any Subcontractor and material suppliers and the requested progress payment and the

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amount to be paid to the Contractor for such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers.

2. Duly executed waivers of mechanics' and material supplier's claims and liens from all Subcontractors and when appropriate, from material suppliers and lower tier Subcontractors establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment; and
3. All information and materials required to comply with the requirements of the Contract Documents or reasonably requested by the Owner or the Architect.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored on the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, including applicable insurance.

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

§ 9.3.4 At the time when final payment for all work, less retainage, is requested, a list of exceptions and a dollar value related thereto will be prepared by the Architect. A monetary value will be assigned to each item so that, if necessary in the professional judgment of the Architect, a supplementary retainage can be withheld in addition to the normal retainage, to cover such exceptions to acceptance.

§ 9.4 CERTIFICATES FOR PAYMENT

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

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

§ 9.5 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

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

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

§ 9.5.3 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 material or equipment suppliers 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 Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment to Contractor within twenty days after receipt of such Certificate of Payment.

§ 9.6.2 The Contractor shall pay each Subcontractor and each supplier of equipment and material no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor or Supplier is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's and suppliers portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor and each supplier of equipment and material require each Subcontractor or Supplier to make payments to Sub-subcontractors and sub-suppliers 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 material and equipment 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 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, except as may otherwise be required by law.

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

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

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

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§ 9.7 FAILURE OF PAYMENT

§ 9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon seven (7) additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.7.2 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to this Contract or the Contract Documents, that payment will be made promptly upon demand by the Owner. Notwithstanding anything contained in this Contract or the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Owner, or if the Owner incurs any costs and expsenses recoverable under applicable laws to cure any default of the Contractor in performance of the Work, or to correct defective Work, the Owner will have an absolute right to offset that amount against the Contract Sum and may, in the Owner's sole discretion, elect either to:

1. Deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner; or
2. Issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

§ 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 and the Owner has received a Certificate of Occupancy from regulatory authorities having jurisdiction over the Project.

§ 9.8.1.1 As applicable, the Contractor shall comply with the provisions of the Public Works Act (R.S.38:2241 et seq.) including those provisions pertaining to the recordation of the Contract and performance and payment bonds, and the preservation of statutory claims. Upon Substantial Completion of the Work and on the recommendation of acceptance by the Architect, the Owner shall accept the work by executing a formal Acceptance or a Certificate of Substantial Completion and the Contractor shall file either the Acceptance of the Certificate with the Recorder of Mortgages or the Clerk of Court of the Parish in which the Work is located. Issuance of the Acceptance or the Certificate of Substantial Completion shall not constitute a final acceptance of the Work.

§ 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. As a prerequisite to the work being accepted by Owner as substantially complete, the Owner must receive executed Roofing Contractor's and Roofing Manufacturer's guarantees, where roofing work is part of the Contract. Further, prior to Architect's inspection to determine Substantial Completion of the Work, the Contractor shall notify the Architect that the project is ready for inspection by the State Fire Marshal's office and any other regulatory authorities having jurisdiction over the Project. 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.

§ 9.8.3.1 The Architect shall make this one additional inspection to determine Substantial Completion; if the work is still not acceptable, the Architect, and each of the Architect's principal consultants, shall be paid $195.00/hour for their time at the Project site, for each additional inspection, to be withheld from the unpaid funds remaining in the Contract Sum. The payment shall be made by the Owner and deducted from the construction contract funds.

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

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

§ 9.8.6 Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the work unless otherwise agreed to in writing by the Owner and Contractor. Unless otherwise agreed to in writing by the Owner and Contractor, security , maintenance, heat, utilities, damage to the Work not covered by the punch list and insurance shall become the Owner's responsibility on the Date of Substantial Completion.

§ 9.8.7 If all punch list items have not been completed by the expiration of the forty-five (45) days claim period, through no fault of the Architect or Owner, the Owner may declare the Contractor in default of the Contract and the surety shall be notified. If within thirty (30) days after notice of default, the surety has not completed the punch list, through no fault of the Architect or Owner, the Owner may, at its option, have the balance of the work completed by whatever means is most expedient and pay for such work with the unpaid funds remaining in the Contract Sum.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project.

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, 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 terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. If the Architect does not find the Work finally complete under the Contract Documents, the Architect shall make one additional inspection; if the work is still not completed, the Architect, and each of the Architect's principal consultants, shall be paid $195.00/hour for their time at the Project site, for each additional inspection, to be withheld from the unpaid funds remaining in the Contract Sum. The payment shall be made by the Owner and deducted from the construction Contract Sum. 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 retainage percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or

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encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and (6) a clear Lien and Privilege Certificate from the Clerk of Court for the Parish, State of Louisiana. 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. If such lien 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 such lien, including all costs and reasonable attorneys' fees.

§ 9.10.2.1 Neither the final payment nor any part of the retainage shall become due until the forty-five (45) day period for filing statutory claims under the Public Works Act (R.S.38.2241 et seq.) has expired, the Contractor has delivered to the Owner a clear lien and privilege certificate issued by the Clerk of Court or Recorder of Mortgages in the parish where the Project is located, which certifies that no statutory claims have been recorded against the Project, , and all affidavits, consents and releases specified in paragraph 9.10.2 have been properly submitted.

§ 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 and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4
(Paragraphs deleted)
Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

(Paragraph deleted)
§ 9.11 LIQUIDATED DAMAGES
§9.11.1 Should the Contractor fail to substantially complete the Work within the Contract Time or any properly granted extension thereof by Change Order, the Contractor shall be liable for and shall pay the Owner the sums stipulated in the Agreement as fixed, agreed, and Liquidated Damages for each calendar day of delay until the Work is substantially complete. It is further understood and agreed that Contractor's failure to achieve Substantial Completion on the date set forth in the Agreement shall constitute a default and breach of the Contract, and that the Contractor specifically waives formal notice of default.

§ 9.11.2 The Contract Time as stated in consecutive calendar days and the Liquidated Damages as stated in Dollars per Day shall be stated in the Agreement.

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 or the Contractor's Subcontractors or Sub-subcontractors; 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.

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§ 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 health and safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities. The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project Site and improvements thereon which could be affected by the performance of the Work. Any damage to such property or improvement arising out of the performance of the Work shall be promptly and adequately addressed and/or repaired by the Contractor at the Contractor's sole cost and expense.

§ 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 to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

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

§ 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, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

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

§ 10.3.2 Upon receipt of the Contractor's written 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 such material or substance or who are to perform the task of removal or safe containment of such material or substance. 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 in the amount of the Contractor's reasonable additional costs of shut-down, 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

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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. Notwithstanding the foregoing, Owner shall have no obligation to indemnify Contractor or its Subcontractors for any materials or substances encountered at the site if said materials or substances were placed or deposited at or about the site by Contractor, its Subcontractors, suppliers, material supplier, vendors or their employees or agents at any time during construction of, or during Contractor's performance of the Work pursuant to the Contract Documents.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for 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 indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance 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 indemnify 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 LIABILITY INSURANCE

§ 11.1.1 The Contractor will purchase and maintain, as its expense, insurance of the types and amounts indicated below in order to protect the Contractor, Owner and Architect from claims that may arise out of or result from the Contractor's operations under the Contract, whether those operations are by the Contractor or by any Subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable. The types of coverage and the limits of coverage required by this Subparagraph are as follows:

.1 All insurance furnished in compliance with this Article shall include the Owner and the Architect as additional insureds and shall waive rights of subrogation against the Owner and Architect. Insurance shall be with a Best's A-rated company or better, acceptable to and approved by the Owner and duly authorized to conduct business in the State of Louisiana. The Owner and Architect so stated on all Insurance Certificates shall be as indicated in the Agreement. All such insurance policies required herein shall be endorsed to reflect and insure any occupancy by the Owner at time of such occupancy.

Type of Coverage	**Limit**
1. Workman's Compensation and Occupational Disease:	Statutory
Employer's Liability:	$1,000,000.00
2. Comprehensive General Liability: Include independent Contractor's Liability; Contractual, Broad Form Property Damage, and Personal Injury Liability; Explosion Collapse and Underground Liability. Owner and Architect to be named as Additional Insureds, and all coverages to be on the Occurrence Form. Completed Operations Liability to be maintained for at least two (2) years after the date of final completion.	

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a. Bodily Injury and Property Damage, combined single limit:

Each Occurrence	$3,000,000.00
General Aggregate	$3,000,000.00
b. Products/Completed Operations Aggregate	$3,000,000.00

3. Automobile Liability: Include owned; non-owned; and hired automobile.

a. Bodily Injury:	
Each Person	$3,000,000.00
Each Accident	$3,000,000.00
b. Property Damage:	
Each Accident	$3,000,000.00

4. Umbrella Liability:

a. Bodily Injury:	
Each Occurrence	$3,000,000.00
Aggregate	$3,000,000.00

5. Builder's Risk: (Contractor will provide, see 11.3.1 below).

§ 11.1.2 The insurance required by Subparagraph 11.1.1 must be in form and substance satisfactory to the Owner and must in all cases be written on an occurrence basis, rather than a claims-made basis. The insurance must be issued by a carrier satisfactory to the Owner and authorized to do business in Louisiana and must be maintained until the entire Work is completed, except that the products and completed operation's coverages must be maintained for at least an additional three-year period following completion of the Work.

§ 11.1.3 Prior to commencement of the work, the Contractor shall forward to the Owner and Architect, two (2) copies each of the Certificate of Insurance evidencing that all required insurance is in force, on an approved Certificate of Insurance Form executed by an authorized representative of the Insurance Company. Copies of all policies must accompany the Certificate of Insurance. Each and every policy and Certificate shall contain an endorsement stating that the Insurance Company will not, prior to completion of project or any policy expiration date shown on the policy and certificate, whichever occurs first, terminate the policy or change any coverage therein without first mailing to the Owner and Architect, by registered mail, written notice of such action at least thirty days prior to the termination or change. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness. Contractor's right to payment is conditioned upon compliance with this Section.

§ 11.1.3.1 The Contractor must certify to the Owner and Architect that he has obtained similar Certificates of Insurance from each of his sub-contractors before their work commences. Each subcontractor must be covered by limits of 1 million per occurrence and 2 million in the aggregate.

§ 11.1.3.2 Indemnity Agreement: The Contractor's Comprehensive General Liability Insurance shall cover the Contractor's contractual obligations under Section 3.18, and this coverage shall be expressly indicated on the Certificate of Insurance.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 Any and all deductibles for the insurance policies requested by the Section shall be assumed by and be at the sole risk and cost of the Contractor or Subcontractor.

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§ 11.1.6 SUBCONTRACTOR
Contractor shall include all subcontractors as insured under its policies or shall furnish separate certificates from each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

§ 11.1.7 DEDUCTIBLES AND SELF-INSURED RETENTIONS
Any deductibles or self-insured retentions must be declared to and approved by the Owner. At the option of the Owner, either the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the Owner, its officers, officials, employees and volunteers or the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses.

§ 11.1.8 OTHER INSURANCE PROVISIONS
The policies are to contain, or be endorsed to contain, the following provisions:

§ 11.1.8.1 General Liability and Automobile Liability Coverages

§ 11.1.8.1.1 The Owner, its officers, employees and directors are to be added as "additional insureds" as respects liability arising out of activities performed by or on behalf of the Contractor, products and completed operations of the Contractor, premises owned, occupied or used by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Owner, its officers, officials, employees or volunteers.

It is understood that the business auto policy under "Who is an Insured" automatically provides liability coverage in favor of the Owner.

§ 11.1.8.1.2 Any failure to comply with reporting provisions of the policy shall not affect coverage provided to the Owner, its officers, officials, employees or directors.

§ 11.1.8.1.3 The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

§ 11.1.8.2 Worker's Compensation and Employer's Liability Coverage
The insurer shall agree to waive all rights of subrogation against the Owner, its officers, employees, directors for damages or losses arising from work performed by the Contractor for the Owner.

§ 11.1.8.3 All Coverages
Each insurance policy required by this Section shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days prior written notice by certified mail, return receipts requested, has been given to the Owner.

§ 11.1.9 ACCEPTABILITY OF INSURERS
Insurance is to be placed with insurers with an A.M. Best's rating of no less than A-:VI.

§ 11.2 OWNER'S LIABILITY INSURANCE
The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 The Contractor shall procure and maintain during life of this Contract an All Risk Builders Policy. The insurance shall include the interests of the Owner, Architect, the Contractor and all Sub-contractors as their interests may appear. Policy shall be of the all physical loss type. It shall be written on the completed Value Form. The policy shall carry a deductible not to exceed $2,500.00 for builders risk. The deductible for wind shall not exceed 5 percent of the contract sum. The Owner, Architect and Contractor shall be the named insureds. Should the Contractor desire to obtain broader Builders' Risk Insurance, the Contractor will purchase such broader coverage at its own expense. Any difference between the Contractors furnished Builder's Risk Insurance and the Contractor's usual risk insurance in any broader type coverage will not affect the Contractor's Liability to the Owner.

(Paragraph deleted)

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§ 11.3.1.1. If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

§ 11.3.1.2 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.3 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

(Paragraphs deleted)

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Contractor shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

§ 11.3.4 If the Owner requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Contractor shall, if possible, include such insurance, and the cost thereof shall be included in an appropriate Change Order.

(Paragraph deleted)

§ 11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Owner .

§ 11.3.7 WAIVERS OF SUBROGATION

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, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, 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 covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Contractor property insurance 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 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method

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of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish a Performance Bond and a Labor and Material Payment Bond in form and substance satisfactory to the Owner, and without limitation, complying with the following specific requirements:

1. The Bonds shall be executed by a good and solvent surety licensed in the State of Louisiana and approved by the Owner, and shall remain in effect for a period not less than five (5) years following the date of Substantial Completion of the Work;
2. The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to the Contract Sum; and
3. The surety on both the Performance Bond and the Labor and Material Payment Bond shall agree that it shall be obligated under the Bonds to any successor, grantee or assignee of the Owner.

§ 11.4.1.1 The Contractor shall deliver the required bonds to the Owner not later than the date of execution of the Agreement, or if the Work is commenced prior thereto in response to a "Notice to Proceed" or letter of intent, the Contractor shall prior to commencement of Work, submit written evidence satisfactory to the Owner such bonds will be issued. The Contractor shall also submit copies to the Architect.

§ 11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

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

§ 11.4.3 The Contractor shall record, prior to commencement of the Work, the Contract (Public Works) or a Notice of Contract (Private Works) and the Performance and Payment Bonds with the Recorder of Mortgages or the Clerk of Court in the Parish in which the Project is located.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated,

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installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.1.1 Defective or nonconforming Work includes but is not limited to movable or adjustable work which has not remained in good working order including hardware, weatherstripping, doors, windows, drawers, apparatus, machinery and electrical and mechanical equipment, except for normal wear.

§ 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 an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4. If the Contractor fails to promptly and properly correct Work identified as defective and/or covered by a general or special warranty, the Owner may declarethe Contractor is in default and notify the Surety. If the Surety fails to cure the default within thirty (30) days of receipt of notice of the default, the Owner may have the work corrected, repaired or replaced by whatever means is most expedient and seek reimbursement of the costs from either the Contractor or its Surety or both.

§ 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, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

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

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

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 Louisiana.

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§ 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 such 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 such assignment.

§ 13.3 WRITTEN NOTICE

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

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Except as expressly provided in the Contract Documents duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

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

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 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 (1) tests, inspections or approvals that do not become requirements until after bids are received and accepted and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

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

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

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

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§ 13.6 INTEREST
Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may 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.

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

§ 13.7.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT
§ 14.1 TERMINATION BY THE CONTRACTOR
§ 14.1.1 The Contractor may terminate the Contract if:

1. The Work is stopped for a period of 30 days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under contract with the Contractor, for any of the following reasons:
    a. Issuance of an order of a court or other public authority having jurisdiction;
    b. An act of government, such as a declaration of nation emergency, making material unavailable or which requires all Work to be stopped;
    c. 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 Subparagraph 9.4.1. or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents.
2. Suspensions, delays or interruptions of the Work by the Owner as described in Section 14.3 constitute in the aggregate more than 50 percent of the total number of days scheduled for completion, or 60 days in any 365 day period, whichever is less.

§ 14.1.2 If one of the reasons described in Section 14.1.1 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.3 If the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

(Paragraph deleted)
§ 14.2 TERMINATION BY THE OWNER FOR CAUSE
§ 14.2.1 The Owner may terminate the Contract if the Contractor

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.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
.4 otherwise is guilty of substantial breach of a provision of the Contract Documents; or-
.5 failure to complete the punchlist within the lien period as provided in 9.8.2.3.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, 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' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of 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 as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

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

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

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

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

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

§ 14.4.3 Upon termination by the Owner for convenience, the Contractor will recover as is sole remedy payment for that portion of the Work and Contractor's portion of overhead and profit thereon, properly performed prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions.

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The Contractor shall be paid for all reasonable costs required to secure the site, terminate subcontracts and purchase orders (including restocking charges) and perform any other work necessary to effect the termination of the Contract. The Contractor shall not be entitled to be paid its anticipated profit or overhead on work not performed prior to the termination. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits. The Owner will be credited for:

.1 payments previously made to the Contractor for portions of the Work previously performed; and

.2 the value for the materials, supplies, equipment, or other items that are to be retained by the Contractor, with acquiescence of Owner, and that are part of the Contract Sum.

§ 14.4.4 Termination of a contract or a portion thereof, shall not relieve the Contractor of responsibility for the completed Work, nor shall it relieve the Surety of its obligation for any just claim arising from the work performed.

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, 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.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Architect. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later; provided, however, that the Claimant shall use its best efforts to furnish the Architect and the other party, as expeditiously as possible, with notice of any Claim once such Claim is recognized, and shall cooperate with the Architect and the party against whom the Claim is made in an effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such Claim.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

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. The Architect will prepare Change Orders and issue Certificates for Payment.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, the Contractor shall document that weather conditions were abnormal for the period of time and had an adverse effect on the critical path of the Project schedule and could not have been reasonably anticipated.

(Paragraphs deleted)

§ 15.1.5.3 The following are considered reasonably anticipated days of adverse weather on a monthly basis:

January	11 days
February	10 days
March	8 days
April	7 days
May	5 days

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June	6 days
July	6 days
August	5 days
September	4 days
October	3 days
November	5 days
December	8 days

The Contractor's request for an extension of time due to adverse weather shall be considered only for those days which exceed the allowable number of days per month set forth herein. The Contract Time is computed on a calendar-day basis.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Architect for initial decision. 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 arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered. Unless the Architect and all affected parties agree, the Architect will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Architect 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 Architect is unable to resolve the Claim if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

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

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

§ 15.2.5 The Architect will render an initial decision approving or rejecting the Claim, or indicating that the Architect is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties 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 an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, 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.

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§ 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 and 9.10.5shall 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 a complaint or demand for arbitration, whichever is appropriate, 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 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. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

(Paragraphs deleted)

§ 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. 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 The Owner, at its sole discretion, 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 The Owner, at its sole discretion, 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.

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§ 15.4.4.2 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 the Owner and Contractor under this Agreement.

(Paragraph deleted)

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DIVISION 1

GENERAL REQUIREMENTS

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New Orleans, LA 70130
Phone: 504-523-6472
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SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Project description.
   2. Type of Contract.
   3. Separate Contracts.
   4. Use of premises.
   5. Contractor’s examination of Site .
   6. Protection.
   7. Work phases.
   8. Owner's occupancy requirements.
   9. Documents to agencies.
   10. Owner-furnished items.
   11. Miscellaneous provisions.

1.3 RELATED REQUIREMENTS

A. Division 01 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.4 PROJECT DESCRIPTION

A. General: The Work of this Project consists of all work identified and otherwise required by the Contract Drawings, including Architectural, Structural, Civil, Mechanical, Plumbing, Electrical, and by the remainder of this Project Manual, including all Divisions and Sections. All Work indicated on the Documents is included in the Scope of this Work unless specifically indicated to be Not in Contract (N.I.C.).

B. Scope of Work: This project consists of the construction of a new 5,995 +/- square foot, one-story Public Safety Complex in Wallace, Louisiana. The project will contain an apparatus bay for two fire trucks, a covered parking canopy for and Ambulance, a gathering room with residential style kitchen, and office and meeting room for the Sheriff, as well as sleeping areas for both fire department and Sheriff personnel for storm related events as well as a lighted, parking lot.
   1. Perform all site demolition work indicated on the Drawings or as otherwise required to accomplish the finished results indicated. The Contractor shall make all required tie-ins to the Owner's existing utilities and shall perform all

necessary shut downs, testing, verifications and certifications. All work of this nature shall be fully coordinated with the Owner.

2. Execute all construction work indicated and otherwise required to achieve the results indicated. The Work is a complete package of work from site demolition to final finishing. New construction shall be complete and finished, ready for the Owner's use. Upon Project completion all areas of construction shall be complete and ready for occupancy by designated users with no additional work by the Owner except for items of work specifically identified as being executed by the Owner or his agent.

1.5 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.6 WORK PHASES

A. The Work shall be conducted in one phase.

1.7 SEPARATE CONTRACTS

A. General: The Contractor shall assist and cooperate fully with the Owner and separate contractors, especially in setting time schedules, work sequences, and utilization of site areas for storage and unloading. The Contractor shall cooperate so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner may award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. A separate contract(s) may be awarded for special systems installations not addressed in this contract.

C. Future Work: Owner may award separate contract(s) for the following additional work to be performed at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
   1. A separate contract(s) may be awarded for the installation of furniture, furnishings and specialized equipment.

1.8 USE OF PREMISES

A. General: Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period. Contractor shall have defined use of premises, as indicated on drawings, for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited to operations directly related to the performance of the Contract and by Owner's right to occupy the adjacent building areas and project site during normal operating hours and to perform work with its own forces and to employ separate contractors on portions of the Project.

B. Use of Site: Limit use of premises to work in areas and areas permitted within the Contract. Do not disturb portions of Project site beyond areas in which the Work as indicated.
   1. Limits: Confine construction operations as indicated on the drawings:
   2. Owner Occupancy: Allow for Owner occupancy of Project site as the completion of project construction will allow. Allow for public use and access to those areas surrounding the Project site.
   3. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, general public and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.9 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
   3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.10 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed on the project site during normal business working hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, except otherwise indicated.
   1. Weekend Hours: Work shall be generally performed on the project site during the hours of 7:00 a.m. to 7:00 p.m.
   2. Early Morning Hours: Coordinate with Owner's representative. Provide 72 hours notice prior to beginning work, minimum.
   3. Hours for Utility Shutdowns: Coordinate with Owner's representative. Provide two week's notice prior to date of anticipated shutdown, minimum. Do not begin work without Owner's representative approval.
   4. Hours for Noisy Construction: Coordinate with Owner's representative. Provide 72 hours notice prior to beginning noisy work, minimum. Do not begin work without Owner's representative approval.

5. Contractor may have additional access to the site outside these hours upon 72 hour notification and approval by the Owner's representative.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect and Owner not less than 7 days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted without Owner's permission.
   1. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows or outdoor air intakes. Smoking is only allowed in designated areas.

D. Employee Identification: Provide identification tags for all Contractor personnel, including, but not limited to subcontractors, vendors and inspectors working on Project site. Require personnel to use and display identification tags at all times.
   1. Maintain list of approved screened personnel with Owner's representative.

1.11 EXAMINATION OF SITE

A. Examination of Documents and Site: Contractor shall carefully examine Documents and the Construction Site to obtain the first-hand knowledge of scope and the conditions of the Work. The Contractor, by signing a Contract to perform the Work, represents and warrants that he has examined Drawings, Specifications and site of the Work and from his own investigation has satisfied himself as to scope, accessibility, nature and location of Work, character of equipment and other facilities needed for performance of work, character and extent of the work to be performed, local availability, practices, and jurisdiction and other circumstances that affect performance of work. Contractor shall make sufficient investigation to ascertain that existing conditions are as represented on the Drawings and that the final results can be achieved as shown on the Drawings. No additional compensation will be allowed by the Owner for failure of Contractor to fully inform himself as to conditions affecting Work. Dimensions of existing site shown on the Drawings may not represent actual dimensions and should be assumed to be approximate. The Contractor shall verify existing dimensions and conditions, which would affect new work before proceeding with actual construction. Contractor will not be entitled to additional compensation if existing dimensions or conditions vary from that shown on the Contract Documents.

B. Contractor's Representation: By executing the Contract, the Contractor represents that he has:
   1. Visited the site;
   2. Made due allowances for difficulties and contingencies to be encountered;
   3. Compared Contract Documents with work in place;
   4. Informed himself of existing conditions, and;

5. Notified the Architect of ambiguities, inconsistencies, and errors discovered in the Contract Documents, or between the Contract Documents and existing conditions.
6. Subcontractors' Representation: Each subcontractor shall similarly represent that he has fulfilled the same responsibilities to the Contractor.
7. Responsibility: Failure to visit the site and perform attendant responsibilities listed above shall not relieve the Contractor or any subcontractor from their obligations, and no extra payment will be authorized for work related to conditions which can be determined by examination of the site and the Contract Documents.

1.12 PROTECTION

A. Protection: During construction the weatherproof and waterproof integrity of the existing structures shall continuously be maintained. Temporary provisions shall be provided wherever and whenever required. The Contractor shall take all reasonable precautions to protect existing property, systems and equipment. All damages to existing structures, systems and spaces resulting from violation of weatherproof integrity shall be rectified by the Contractor at no expense to the Owner. Additionally, at completion of the Work, all areas of the site damaged or otherwise adversely affected by the work under this Contract shall be repaired, replaced, or otherwise returned to their original conditions without cost to the Owner.

1.13 DOCUMENTS TO AGENCIES

A. The Owner has submitted documents to the State Fire Marshal. The Contractor shall pay for any additional permits, reviews, fees and inspections required by authorities having jurisdiction after signing the Owner/Contractor Contract. All other required arrangements, including but not limited to, the securing of occupancy certificates, scheduling and passing inspections, etc., shall be the responsibility of the Contractor. **THE CONTRACTOR IS REQUIRED TO PAY FOR ALL PERMITS**.
   1. SWPPP – Storm Water Pollution Prevention Plan: The contractor shall prepare, file, maintain and close with the proper agencies.
   2. Contractor shall be responsible for all building permits, utility connection fees and all permits including Substantial Completion and occupancy of building.
   3. Subcontractors shall be responsible for permits in each discipline.

1.14 OWNER-FURNISHED ITEMS

A. OWNER-FURNISHED PRODUCTS
   1. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections. The Contractor shall review this information and advise the Architect of any observed potential conflicts or problems related to Owner-furnished items.
      a. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
      b. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule. The Contractor is responsible for

designating the delivery dates of Owner-Furnished items in the Construction Schedule. These dates must be flagged on each Schedule.

c. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
d. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
e. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
f. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
g. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
h. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements, and to repair or replace items damaged as a result of operations under the Contract.

2. Owner-Furnished/Owner Installed Products: The Owner will provide under separate contract materials and equipment items as indicated on the Drawings. The work under this contract includes support systems (wall blocking, ceiling support, support as required for installation) to receive and support Owner's equipment, and mechanical and electrical services and connection. The Contractor and Owner's Contractor shall coordinate all rough-in openings, mechanical and electrical requirements for a smooth installation. Items include and are not limited to the following:
   a. Computer System Servers.
   b. Computer Stations and associated computer/data/IT equipment.
   c. Coin Tower.
   d. Copiers.
   e. Add-Value Station.
   f. Self-Check Machines.
   g. I.T. Equipment.
   h. OPAC Unit.
   i. Flat Screen TV monitors.
3. Owner-Furnished/Contractor Installed Products: The Owner will furnish under separate contract materials and equipment items to the project site as indicated on the Drawings. The work under this Contract includes complete installation, including support systems (wall blocking, ceiling support, support as required for installation) to receive and support Owners equipment, and mechanical and electrical services and connections. The Contractor shall be responsible for coordinating all rough-in requirements and the installation of the materials and equipment. Items include and are not limited to the following:
   a. Microwave Oven.
   b. Refrigerator.

1.15 MISCELLANEOUS PROVISIONS

A. Removal and Reinstallation of Work: Additional payment will not be authorized for relocation, removal, and/or temporary removal and reinstallation of any existing or

newly installed construction (ducts, conduit, piping, wiring, fixtures, equipment, finishes, sidewalks, etc.) necessary to properly complete the Work, which could have been anticipated by careful examination of the site and the Documents. Such Work shall be performed, without additional cost to the Owner.

B. The Contractor shall be responsible for the preservation of all public and private property, monuments, highway signs, telephone lines, other utilities, etc., along and adjacent to the Work; shall use every precaution necessary to prevent damage to pipes, conduits, and other underground structures; and shall protect carefully from disturbance or damage all land monuments and property marks until an authorized agent has witnessed or otherwise referenced their locations and shall not remove them until directed. The street and highway signs and markers, that are to be affected by the Work, shall be carefully removed when the work begins and stored in a manner to keep them clean and dry. The Contractor must obtain all necessary information in regard to existing utilities, and shall give notice in writing to the Owners of the property or the authorities in charge of streets, gas, water, pipes, electric, sewers and other underground structures, including conduits, railways, poles and pole lines, manholes, catch basins, fixtures, appurtenances, and all other property that may be affected by the Contractor's operations, at least three (3) working days before his operations will affect such property or as specified elsewhere. The Contractor shall not hinder or interfere with any person in the protection of such work or with the operation of utilities, at anytime.

C. When property or the operation of railways, telephone lines, telegraph lines or other public utilities are endangered, the Contractor shall at his own expense, maintain flagmen or watchmen and any other necessary precautions to avoid interruption of service or damage to life or property, and shall promptly repair, restore, or make good injury or damage caused by his operations in an acceptable manner.

D. Exploratory Utility Excavation: Utilities exploration shall include all labor, materials, and equipment necessary for the Contractor to conduct a field investigation including exploratory excavations in advance of construction for the purpose of determining the existing location, size, and depth of all underground utilities shown or identified on the Drawings, any and all meetings with representatives of each utility, and furnishing the information to the Engineer. In addition to those utilities on the Drawings, the Contractor shall also make exploratory excavations of all utilities which could impact the construction. This work shall include all test pit excavations including backfilling with sand, compaction, dewatering, pavement removal and replacement, and other related items.

E. Owner will provide Contractor three (3) sets of Construction Documents for use during construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 1028

PARISH TAX EXEMPT STATUS – FILING PROCEDURES

PART 1 - GENERAL

1.1 PROCEDURES

A. St. John the Baptist Parish, as a political subdivision of the State of Louisiana, is a tax-exempt entity. As such, St. John the Baptist Parish reserves their right to take advantage of their tax status on any or all purchases of material(s) being incorporated into this project. The Contractor and Subcontractors hereby agree to cooperate in providing information relating to the value of materials to be purchased for the purpose of the St. John the Baptist Parish's monitoring and documenting of all materials purchased free of sales tax.

B. The Contractor and Subcontractors are to include all required state and local sales or use tax in their bid proposals as it will be the option of the Parish to take advantage of their tax exempt status.

C. All aspects of purchasing will be monitored by a "Construction Professional" employed by the St. John the Baptist Parish. Prior to a proceed order being issued, the Contractor and Subcontractors will meet with the monitor to establish dollar amounts included in their estimates for materials by Divisions or Subdivisions thereof, of the specifications. Upon proceeding, as purchase order amounts are established and issued, the information shall be made available to the monitor to post against the established material values. As monthly payment requests are processed and payment made to the General Contractor, actual invoice amounts expended toward the purchase order(s) shall be made available to the monitor with proper documentation.

D. Separate columns for the materials and sales taxes will be set up on the Payment Request format. Only the sales tax value will be deducted for material purchases and no Contractor's or Subcontractor's labor, insurance, equipment, overhead, mark-up or bonds will be deducted from the particular line item. The material's tax value will be deducted as each monthly payment request is submitted by the Contractor, thereby being paid for the percentage of the completed work on a given line item less the value of the sales tax.

E. Periodically deductive Change Orders will be issued for the tax savings with a final deductive Change Order being issued at the completion of the project, thereby reducing the total Contract amount due the Contractor by the value of the material's sales tax. This states that taxes which are to be included in the bid will be recouped through periodic deductive Change Orders throughout this job.

F. The Contractor and/or Subcontractors remain entirely responsible for establishing delivery dates, receiving, protecting and/or storing the materials from the vendor(s) and installing same. The Contractor shall at all times have the care, custody and control of the materials and maintain insurance sufficient to cover the value of the materials.

It shall be stated on each purchase order "All materials furnished with this purchase order shall be shipped to _____, Contractor, and used exclusively on Owner Project No. 21238.00, identified as the St. John the Baptist Parish, West Bank Public Safety Complex, located in Wallace, LA.

G. Follow direction of Owner's instructions and documentations.

1.2 INDEMNIFICATION

A. St. John the Baptist Parish, as Owner, agrees to indemnify, defend and hold Contractor fully harmless from and with respect to any State or local sales or use tax liability claimed, alleged, or asserted by any State or local government agency with respect to the purchase, use, consumption or storage of materials and supplies and rental of equipment on which any said claim is based were made strictly in accordance herewith and further provided that the items in question were purchased or rented exclusively for this particular Project and delivered by the vendor or vendors in question directly to job site or to a bonded storage facility. Specifically, this agreement to indemnify, defend and hold harmless from and with respect to sales and/or use taxes shall not apply in the case of any materials or supplies purchased by Contractor or Subcontractors for their own inventory.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:
   1. Administrative and procedural requirements for Alternates.
   2. Schedule and general description of Alternates.
B. Related Sections include:
   3. Louisiana Uniform Public Work Bid Form: List of Alternates to be bid.

1.3 DEFINITIONS

A. Alternate: An Alternate is a change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
   1. An Alternate Bid is a cost, proposed by Bidders and stated on the Bid Form that may be added to or deducted from the Base Bid for the change in construction activities defined by the Alternate.
   2. The decision to accept or not accept any Alternate and the corresponding change in the Bid Sum is at the sole discretion of the Owner.
   3. The Alternate Bid amount shall include the Contractor's overhead and profit, and all costs for the change in construction activities, including related coordination, submittals, testing, adjusting and cleaning, and modifications and adjustments to other construction necessary for the proper implementation and incorporation of the Alternate.

1.4 PROCEDURES

A. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
B. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.
C. Accepted Alternates: Execute accepted Alternates under the same conditions as other Work of this Contract.

D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule of Alternates contain requirements for materials necessary to achieve the Work described under each Alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: The "Schedule of Alternates" and applicable Specifications Sections contain requirements for execution necessary to achieve the Work under the Alternates.

3.2 SCHEDULE OF ALTERNATES

A. General: Provide all materials, labor, equipment and other items as required to fully perform and complete the Work of the Alternates generally described herein and as delineated on the Drawings.

ALTERNATE NO. 1: UPGRADE FROM VCT 1, 2 &3 TO LVT 1,2 & 3

Additive Alternate: All work involved with upgrading VCT 1, VCT 2 and VCT 3 to LVT 1, LVT 2 and LVT 3. Work includes, but is not limited to as indicated in the following:

1) **Specifications:**
   a. Section 09 6500 – Resilient Flooring.

2) **Sheets:**
   a. A701 – Finish Plan.

ALTERNATE NO. 2: Not Applicable

ALTERNATE NO. 3: Not Applicable

END OF SECTION

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. **Administrative** and procedural requirements for handling and processing contract modifications as follows:
1. Minor Changes in the Work
2. Change Order Proposal requests.
3. Construction Change Directives.
4. Change Order Procedures.

1.3 RELATED REQUIREMENTS:

A. Document 00 7200 – General Conditions of the Contract for Construction – AIA A201 2017.

B. Section 01 2900 - Payment Procedures: Administrative procedures governing applications for payment.

C. Section 01 3200 - Construction Progress Documentation: Contractor's construction schedule.

D. Section 01 6300 - Product Substitution Procedures: Administrative procedures for handling requests for product substitutions after award of the Contract.

1.4 MINOR CHANGES IN THE WORK

A. **Supplemental instructions:** In accordance with General Conditions - Paragraph 7.4, the Architect will issue supplemental instructions, in writing, authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time.

1.5 CHANGE ORDER PROPOSAL REQUESTS

A. **General:** Provisions for Change Orders are specified in General Conditions (Resolution No. 113647) – "Article 10 - Changes in the Work; Claims".

B. **Work Change Proposal Request (WCPR):** Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
2. Unless otherwise indicated in the proposal request, within 10 calendar days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost to execute the proposed change. Include an itemized list of work to be added or deleted with labor and material unit costs including subcontracts. If

requested, substantiate costs and quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

3. State the effect the proposed change in the Work will have on the Contract Time.

C. Contractor Initiated Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, or when the Contractor considers a change may benefit the Owner by expediting construction, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include an itemized list of work to be added or deleted with labor and material unit costs. When requested, substantiate costs and quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
3. Comply with requirements of "Section 01 6300 - Product Substitution Procedures" if the proposed change in the Work involves the substitution of one product or system for a product or system specified.

D. Authorization to Proceed with Change: When the Contractor and the Architect are in agreement regarding adjustment to the Contract Sum and/or Contract Time resulting from a proposed change in the Work, the Architect will prepare a formal Change Order fully describing the change and specifying any adjustment to the Contract Sum and/or Contract Time. This Change Order shall be signed by the Architect, the Owner, and the Contractor and shall become part of the Contract Documents when signed by all three.

1.6 CONSTRUCTION CHANGE DIRECTIVES

A. Construction Change Directives: When the Owner determines it is in the best interest of progress of the work, or when the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal, the Owner may issue a Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum and/or Contract Time.

B. Documentation: If the Construction Change Directive so orders, the Contractor shall maintain detailed records of workers' time and material used in performing the work required by the Construction Change Directive.

1. After completion of the change, the Contractor shall submit an itemized account and supporting data, including subcontract breakdowns, necessary to substantiate cost and time adjustments to the Contract and permit preparation of a Change Order.

1.7 CHANGE ORDER PROCEDURES

A. Change Order Form: Upon the Owner's approval of a Work Change Proposal Request, Contractor Initiated Proposal Request, or Construction Change Directive, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G 701, as provided in the Conditions of the Contract.

B. Time Extensions: Extension of Contract Time, whether or not related to a change in Contract Sum will be authorized By Change Order.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes:** Administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Related Sections:
1. Section 01 3100 - Project Management and Coordination.
2. Section 01 3119 - Project Meetings.
3. Section 01 3200 - Construction Progress Documentation: Contractor’s construction schedule.
4. Section 01 7700 - Closeout Procedures.

1.3 SCHEDULE OF VALUES

A. **General:** Submit a Schedule of Values as required by General and Supplementary Conditions. Coordinate preparation of the Schedule of Values with other administrative schedules and forms, including:
1. Contractor's construction schedule (Section 01 3200).
2. List of subcontractors and major suppliers (General Conditions).
3. Products list (Section 01 3300).
4. Schedule of submittals (Section 01 3300).

B. **Submittal Date:** Submit the Schedule of Values to the Architect at the Pre-Construction Conference specified in Section 01 3119.

C. **Format and Content:** Prepare the Schedule of Values on AIA Document G703, using columns A, B, and C. Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
1. Content: Indicate the following for each item listed:
   a. Related Specification Section number and name.
   b. Quantity of work (number of units, sq. ft., etc.).
   c. Dollar value to nearest whole dollar, adjusted to equal total Contract Amount.
2. Job Overhead Costs: At the Contractor's option, administrative costs, superintendence, temporary facilities and other major cost items that are not directly related to cost of actual work in place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense

1.4 APPLICATIONS FOR PAYMENT

A. **Payment Application Requirements:** In accordance with General and Supplementary Conditions, submit monthly Application for Payment with required supporting data.
1. General: Each Application for Payment shall be consistent with the Schedule of Values and with previous applications and payments as certified by the Architect and paid by the Owner.
2. Notarization: Each Application for Payment shall be notarized.
3. The Contractor shall submit monthly updates of the project schedule with each

application for payment. Owner's obligation to make payment is contingent upon Contractor's compliance with this requirement.

4. Special Requirements: The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Times: Progress payments shall be submitted to the Architect no later than the 26th day of the month. The period covered by each Application for Payment is one month ending on the 25th day of the month.

C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and current Contractor's Construction Schedule.
2. Include as additional line items amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit original and 3 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours.

1. Architect will transmit original certification to the Owner, one copy with certification to Contractor. Architect will retain one copy for records. Resident Project Representative will retain one copy.

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

1. List of subcontractors and major suppliers (General Conditions).
2. Schedule of Values (Section 01 2900).
3. Contractor's Construction Schedule (Section 01 3200).
4. Submittal Schedule (Section 01 3300).
5. List of Contractor's staff assignments (Section 01 3100).
6. Copies of building permits (General Conditions).
7. Copies of authorizations and licenses from governing authorities for performance of the Work (General Conditions).
8. Certificates of insurance and insurance policies (General Conditions).

G. Application for Payment at Substantial Completion: Following issuance of the AIA Document G704-2000 Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Beneficial Occupancy Forms issued previously for Owner partial occupancy of designated portions of the Work.

1. Administrative actions and submittals that shall proceed or coincide with this application are specified in Section 01 7700.
2. In the Application for Payment that first follows the date of Substantial Completion, show 100 percent completion for the portion of the Work claimed as substantially complete.
   a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

H. Final Payment Application: Administrative actions and submittals which must precede or coincide with the final Application for Payment are specified in "Section 01 7700 - Closeout Procedures".

1.5 MOBILIZATION / DEMOBILIZATION

A. Partial payments for Mobilization/Demobilization will be divided into five (5) payments being made to spread the costs over the duration of the project. No price adjustment will be made for this due to changes and/or extensions of time and any increased mobilization cost incurred by the Contractor due to any additional work occasioned by such changes.

B. Partial payments for mobilization shall be made in accordance with the schedule of Table 1150-1, based on the percent earned of original total contract amount (less the Line Item for Mobilization/Demobilization), for a total amount equal to the line item for Mobilization / Demobilization.

Table 1150 – 1
Mobilization/Demobilization Payment

Percent of Total Contract Amount Earned (Excluding the Line Item for Mobilization/Demobilization)	Allowable Percent of the Lump Sum Price for Mobilization/Demobilization
1st Partial Estimate	25% of Line Item Amount
10% of Contract Amount	50% of Line Item Amount
25% of Contract Amount	75% of Line Item Amount
50% of Contract Amount	85% of Line Item Amount
100% (at Substantial Completion)	100% of Line Item Amount

If the Contract is cancelled by the Owner, the Contractor will be paid for the actual cost for mobilization at the time of cancellation, which said cost shall not exceed the total amount bid under this item.

Nothing herein shall be construed to limit or preclude partial payment otherwise provided by the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes:** Requirements for project coordination include, but not necessarily limited to:

1. Construction activities.
2. Submittals.
3. Requests for Information (RFIs).
4. General installation provisions.
5. Cleaning and protection.

B. Related Sections include:

1. Document 00 7200 – Conditions of the Contract for Construction.
2. Section 01 1000 - Summary: Required special coordination related to other contractors and simultaneous use and occupancy of the adjacent buildings.
3. Document 01 3100.13 –Request for Information Form.
4. Section 01 3200 - Construction Progress Documentation: Contractor's Construction Schedule.
5. Section 01 6000 - Product Requirements: Coordinating general installation.
6. Section 01 7700 - Closeout Procedures: Coordinating Contract closeout.

1.3 CONSTRUCTION ACTIVITIES

A. **Coordination:** Coordinate and schedule activities (including submittals, testing, and preparations) to assure efficient and orderly installation of each part of the Work. See additional requirements in "Section 01 3200 – Construction Progress Documentation."

1. Sequence activities to obtain the best installation and in-place performance.
2. Coordinate installation of components to assure adequate accessibility for installation, maintenance, service and repair.
3. Make necessary provisions for items scheduled for later installation under the Contract and by separate contractors.
4. Schedule product deliveries to assure continuity and proper sequence of operations, without delay and interruptions.
5. Verify that equipment items are suitable for available mechanical and electrical systems.

B. **Communications:** Where necessary, distribute instructions for coordination.

1. Prepare and issue memoranda for the Owner and separate contractors where coordination of their work is required.

C. **Administrative Procedures:** Coordinate administrative activities with

construction to avoid delays and assure orderly progress of the Work. Such activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Project closeout activities.

1.4 SUBMITTALS

A. Staff Names: Within 15 days after Notice to Proceed, submit a list of Project staff assignments, with individual names, their assignments, telephone numbers and mailing addresses.

B. Coordination Drawings: Prepare and submit Coordination Drawings for installation of products and materials.

1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in "Section 01 3200 - Construction Project Documentation".

1.5 REQUESTS FOR INFORMATION (RFI) DOCUMENT 01 3100.13

A. Coordination: All requests for information generated by subcontractors, vendors, etc. shall be submitted to Contractor for investigation and response.

1. If, in the opinion of the Contractor, the requested information requires an interpretation or decision by the Architect, the Contractor shall submit a request for information (RFI) to the Architect.

B. RFI Form: All requests for information shall be submitted to the Architect on the form included at the end of this Section. No other forms will be accepted.

1. All applicable spaces on the RFI form shall be filled-out.

C. Response: Architect will render a response within 15 days of receipt of the completed RFI form.

1. Incomplete RFIs will be returned "without action" for resubmittal.
2. RFIs that do not require an interpretation of the Contract Documents for the execution of the Work will be returned "Not Applicable."
3. Commencement of the Work in accordance with the Architect's RFI response shall indicate Contractor's acknowledgment that there will be no change in the Contract Sum or Contract Time.

D. RFI Logs: Contractor shall prepare and maintain a log of RFIs containing the following:

1. Project name and number.
2. Contractor name, address, telephone and fax number.
3. Spread sheet type categories for RFI number, company/contractor initiating RFI, date issued, date response requested, date response received.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed.

Do not proceed until unsatisfactory conditions have been corrected.

B. Visual Effects: Provide uniform joint width in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

3.2 CLEANING AND PROTECTION

A. During Handling and Installation: Clean and protect construction in progress and adjoining materials in place.

1. Apply protective covering where necessary to ensure protection from damage or deterioration at Substantial Completion.
2. Clean and maintain completed construction through the remainder of the construction period.

B. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to excessive loading, damaging temperature and humidity extremes, staining, contact between incompatible materials, and similar harmful and deteriorating exposure during the construction period.

C. Repair and Replacement: If any parts of the construction are deteriorated, become damaged, develop defects, or are otherwise not in compliance with requirements of the Contract, they shall be cleaned, restored to proper condition, repaired acceptably, or replaced with new products prior to requesting Architect's inspection for Substantial Completion or Final Completion.

END OF SECTION

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DOCUMENT 01 3100.13 -REQUEST FOR INFORMATION (RFI)

From: _____ **Date:** _____ **RFI No:** _____

_____ **Cc:** _____

_____ _____

_____

To: Sizeler Thompson Brown Architects
Regional Design Group, LLC
300 Lafayette Street, Suite 200
New Orleans, La 70130

504-523-6472 Fax 504-529-1181

Reference: Spec Section _____
Drawings: _____

Attachment: ☐ Yes ☐ No

Attn: _____ **Date Response Requested:** _____

Subject: _____

Question: _____

_____

_____

_____

Proposed Solution: _____

_____

_____

_____

_____

_____

_____

_____

Signed: _____

P.O.R. Response: _____

_____

_____

_____

_____

Signed: _____ **Date:** _____

NOTE: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

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SECTION 01 3119

PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes:** Administrative and procedural requirements for project meetings, including, but not limited to:

1. Procedures.
2. Pre-construction conference.
3. Pre-installation conferences.
4. Progress meetings.
5. Called meetings.

B. Related Sections include:

1. Section 01 3100 - Project Management and Coordination: Coordinating Project meetings with other construction activities.
2. Section 01 3200 - Construction Progress Documentation: Contractor's Construction Schedule.

1.3 PROCEDURES

A. **General:** Requirements of this Section amplify and do not modify provisions of the General and Supplementary Conditions. This Section specifies administrative and procedural requirements for Project meetings.

B. **Contractor's Responsibility:** Project meetings are administrative activities to facilitate the Contractor's direction of the Work. As such, it is the responsibility of the Contractor to implement understandings reached during meetings, unless otherwise stated.

C. **Location:** Unless otherwise agreed in advance, hold meetings at the Project site.

D. **Pre-Construction Conference:** The Architect will keep minutes of meeting and promptly distribute copies to the Owner, and the Contractor. The Contractor shall distribute minutes to Subcontractors, other attendees and interested parties.

E. **All Other Project/Construction Meetings:** The Contractor will keep minutes of meetings and promptly distribute copies to the Owner, the Architect and other attendees and interested parties.

F. **Attendance:** Contractor shall require attendance at meetings of Owner, General Contractor and Architect. The Architect will attend in the capacity of the Owner's representative and interpreter of Contract requirements.

G. **Additional Meetings:** The Contractor shall arrange for meetings, in addition to those specified in this Section, as necessary for the performance of the Work according to the Contractor's schedule, or as instructed by the Architect at the request of the Owner.

1.4 PRE-CONSTRUCTION CONFERENCE

A. General: After notification that the Contract has been executed, the Architect shall arrange with the Owner, and Contractor, and conduct a Pre-Construction Conference to be held at the Project site. The Contractor shall be responsible to see that his principal subcontractors are in attendance and shall furnish to the Architect, Owner, and the following:

1. Schedule of Values.
2. List of subcontractors and material suppliers.
3. Contractor's Construction Schedule.
4. Documentation, qualification data and certificates as required by Owner and/or Architect.

B. Attendees: The Owner, Architect and Architect's consultants, the General Contractor and its superintendent, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Minimum Agenda: Distribute data on, and discuss:

1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, material suppliers, and Architect.
2. Channels and procedures for communications.
3. Construction schedule, including sequence of critical Work.
4. Contract Documents, including distribution of required copies of original Documents and Revisions; Owner's acceptance/rejection of Alternates.
5. Processing of Shop Drawings and other data submitted to Architect for review.
6. Processing for field decisions and Change Orders.
7. Rules and regulations governing performance of Work.
8. Security.
9. Quality control.
10. Housekeeping.
11. Equipment deliveries and priorities.
12. Parking availability.
13. Office, work, and storage areas.
14. Use of premises.
15. Preparation of Record Documents.
16. Working hours.
17. Policy for Owner initiated delay days.
18. Mechanical systems – testing, adjusting, and balancing.

1.5 PRE-INSTALLATION CONFERENCES

A. Requirements: The Contractor shall arrange and conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Owner and Architect of scheduled meeting dates.

B. **Purpose:** Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

1. Contract Documents.
2. Options.
3. Related Change Orders.
4. Purchases.
5. Deliveries.
6. Shop Drawings, Product Data and quality control samples.
7. Possible conflicts.
8. Compatibility problems.
9. Time schedules.
10. Weather limitations.
11. Manufacturer's recommendations.
12. Compatibility of materials.
13. Acceptability of substrates.
14. Temporary facilities.
15. Space and access limitations.
16. Governing regulations.
17. Safety.
18. Inspection and testing requirements.
19. Required performance results.
20. Recording requirements.
21. Protection.

C. **Reporting:** Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.

D. **Problems:** Do not proceed with affected work if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.6 PROGRESS MEETINGS

A. **Requirements:** The Contractor shall schedule and conduct progress meetings at regular monthly intervals, unless otherwise scheduled during construction.

B. **Attendees:** The Owner, Architect, and Contractor shall meet and review the current status and future expected progress of the project.

C. **Agenda:** Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine status of each activity in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how work behind schedule will be expedited; secure commitments from parties involved to do so. Discuss need for schedule revisions to ensure that current and subsequent activities will be completed within the Contract Time.
2. Review the present and future needs of the contractor, including such items as:
   a. Coordination requirements

b. Submittals
c. Open RFI's
d. Time
e. Sequences
f. Deliveries
g. Off-site fabrication problems
h. Access
i. Site utilization
j. Temporary facilities and services
k. Hours of Work
l. Safety
m. Housekeeping
n. Quality and Work standards
o. Change Orders
p. Documentation of information for payment requests

D. Reporting: After each progress meeting date, the Contractor shall send copies of meeting minutes to the Owner, the Architect and to other parties present and to other parties who should have been present.

1. Action: Responsibility for action and date for completing action shall be indicated for each item requiring resolution.

E. Schedule Updating: The Contractor shall revise the construction schedule prior to each progress meeting where revisions to the Schedule have been made or recognized. The Contractor shall issue the revised Schedule as specified in Section 01 3200.

1.7 CALLED MEETINGS

A. Called meetings may be scheduled in addition to regularly scheduled Progress Meetings. All applicable personnel will be required to attend.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Daily construction reports.
   4. Field condition reports.

1.3 RELATED REQUIREMENTS

A. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
B. Section 01 3300 – Submittal Procedures: for submitting schedules and reports.
C. Section 01 4000 – Quality Requirements: for submitting a schedule of tests and inspections.

1.4 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.
B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.
C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
E. Events: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
H. Major Area: A story of construction, a separate building, or a similar significant construction element.
I. Milestone: A key or critical point in time for reference or measurement.
J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.5 SUBMITTALS

A. Submittals Schedule: Submit two (2) copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.
   7. Monthly report samples.
   8. Project analysis plan.
B. Preliminary Network Diagram: Submit two (2) opaque copies, large enough to show entire network for entire construction period. Show logic ties for activities.
C. Contractor's Construction Schedule: Submit two (2) opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
   1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
D. CPM Reports: Concurrent with CPM schedule, submit two (2) copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
E. Daily Construction Reports: Submit two copies at monthly intervals.

F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

1.6 SUBMISSION AND REVIEW

A. Preliminary Meeting: Participate in preliminary meeting to discuss proposed schedule, requirements of this Section prior to submission of network.
B. Proposed Plan: Submit a schedule for the first 180 days of the work within 14 days of Contract Award. Submit complete schedule within 35 calendar days after Contract Award.
C. Review and Evaluation: Contractor participates in review, evaluation of proposed plan and analysis by Architect and the Owner. Revisions necessary as a result of review resubmittal for acceptance within 10 calendar days after meeting. Accepted schedule to be used for planning, organizing, directing work, reporting progress and requesting payment for work accomplished.
D. Monthly Reports: Submit monthly report of actual construction progress by updating required sorts, time scaled logic diagram. Initially and monthly thereafter, produce projected report of scheduled activities to be started, in process or completed during upcoming reporting period, sorted by early start. At end of reporting period, Contractor shall make entries on preceding Look-Ahead Report to show actual progress. As a minimum, following action will be accomplished:
    1. Identify activities started and completed during previous period.
    2. Show estimated duration (in work days) to complete each activity started but not completed.
    3. Indicate percentage of cost payable for each activity.
    4. Reflect changes in network diagram.
    5. Show conformed modifications, pending proposed changes on update report. Produce, from marked-up Look-Ahead Report, updated required sorts for project and use accumulated cost for completed and partially completed activities as basis for requesting progress payments. Contract status evaluated on basis of relative float on critical path at time of updating with negative relative float indicating contract is behind schedule and positive relative float indicating status ahead of schedule. (Relative float is the current status of an activity in relation to approved schedule completion date.)

1.7 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
    1. Secure time commitments for performing critical elements of the Work from parties involved.
    2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 14 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
   4. Startup and Testing Time: Include not less than 15-30 days for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Uninterruptible services.
      d. Partial occupancy before Substantial Completion.
      e. Use of premises restrictions.
      f. Provisions for future construction.
      g. Seasonal variations.
      h. Environmental control.
   2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

3. Area Separations: Identify each major area of construction for each major portion of the work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
   a. Structural completion.
   b. Permanent space enclosure.
   c. Completion of mechanical installation.
   d. Completion of electrical installation.
   e. Substantial completion.

D. Milestones: Milestones are a key or critical point in time for reference or measurement. The following MANDATORY milestone topics should be including in your critical path project schedule as a condition of acceptance of the project schedule. Include milestones indicated below but not limited to the following:
   1. Notice to Proceed
   2. Temporary utilities
   3. Exterior façade
   4. Plumbing rough-in
   5. Electrical rough-in
   6. Mechanical rough-in
   7. Substantial Completion
   8. Final Completion

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
   1. See Section 01 2900 - "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

I. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within **30** days of date established for the **Notice to Proceed.** Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
   1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within **30** days of date established for the **Notice of Award**. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule Preparation: Prepare Contractor's Construction Schedule using a computerized, cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
   1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 5 days before the preconstruction meeting.
      a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
   2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   3. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
   a. Preparation and processing of submittals.
   b. Mobilization and demobilization.
   c. Purchase of materials.
   d. Delivery.
   e. Fabrication.
   f. Utility interruptions.
   g. Installation.
   h. Testing.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
   a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.

2. Equipment at Project site.
3. Material deliveries.
4. High and low temperatures and general weather conditions.
5. Accidents.
6. Meetings and significant decisions.
7. Stoppages, delays, shortages, and losses.
8. Meter readings and similar recordings.
9. Emergency procedures.
10. Orders and requests of authorities having jurisdiction.
11. Change Orders received and implemented.
12. Construction Change Directives received.
13. Services connected and disconnected.
14. Equipment or system tests and startups.
15. Partial Completions and occupancies.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 3 days before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 3233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Sections:
1. Division 01 "Submittal Procedures" for submitting photographic documentation.
2. Division 01 "Payment Procedures" for submittal of photos with each pay application.
3. Division 01 "Closeout Procedures" for submitting photographs as Project Record Documents at Project closeout.
4. Division 31 “Driven Piles”, “Pre-stressed Concrete Piling”, Augered Cast-in-Place Piles” for preconstruction photographic requirements.

1.3 SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.

B. Preconstruction and Construction Photographs: Submit one print of each photographic view within seven days of taking photographs.
1. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints on CD-ROM. Identify electronic media with date photographs were taken, along with "date imprint" visible on each photographic image to verify date of recording. Submit images that have same aspect ratio as the sensor, uncropped.
2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
   a. Name of Project.
   b. Name and address of photographer.
   c. Name of Architect.
   d. Name of Contractor.
   e. Date photograph was taken, along with "date imprint" visible on each photographic image.
   f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

g. Unique sequential identifier.

C. Photographer Qualifications: Provide photographer qualification.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.6 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8.0 megapixels and at an image resolution of not less than 1024 by 768 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in filename for each image.
2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, (2 block radius) underground utilities, and other construction. Provide photographs of conditions that might be misconstrued as damage caused by pile

driving. Photographs must be of quality and detail to clearly document all pre-existing conditions of the adjacent structures with respect to structural foundations, building cracking/shifting, etc. Contractor is required to obtain adjacent property owner's authorization to photograph exterior and interior pre-existing conditions. Exterior photographs must be documented with vegetation and other visual barriers avoided. Photographs to be taken behind vegetation and barriers with appropriate detail and lighting control to view conditions clearly.

1. All photographs must have "date imprint" visible on photographic image to verify date of recording.
2. Flag construction limits before taking construction photographs.
3. Take a minimum of eight photographs to show existing conditions adjacent to property before starting the Work.
4. Take a minimum of eight photographs of existing conditions either on or adjoining property to accurately record physical conditions at start of construction.

   Take additional photographs as required to record settlement or cracking of adjacent structures, pavements and improvements.
5. Inventory and record the condition of adjacent structures, (a minimum of 2 block radius) underground utilities and other construction. Provide photographs of conditions that might be misconstrued as damage caused by pile driving. Photographs must be of quality and detail to clearly document all pre-existing conditions of the adjacent structures with respect to structural foundations, building cracking/shifting, etc. Contractor is required to obtain adjacent property owner's authorization to photograph exterior and interior pre-existing conditions. Exterior photographs must be documented with vegetation and other visual barriers avoided. Photographs to be taken behind vegetation and barriers with appropriate detail and lighting control to view conditions clearly.

D. Periodic Construction Photographs: Take twelve (12) color, digital photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

1. Show status of construction and progress since last photographs were taken.
2. During each of the following construction phases, take shots from same vantage point each time to create a time-lapse sequence as follows:
   a. Commencement of the Work, through completion of subgrade construction.
   b. Above-grade structural framing.
   c. Exterior building enclosure.
   d. Interior Work, through date of Substantial Completion.

E. Final Completion Construction Photographs: Take twenty (20) color photographs after date of Substantial Completion of submission as project record documents. Architect will inform photographer of desired vantage points.

1. Do not include date stamp.

F. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:
   a. Special events planned at Project site.
   b. Immediate follow-up when on-site events result in construction damage or losses.
   c. Photographs to be taken at fabrication locations away from Project site.
   d. Substantial Completion of a major phase or component of the Work.
   e. Extra record photographs at time of final acceptance.
   f. Owner's request for special publicity photographs.

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Subcontractors/materials list.
2. Submittal schedule.
3. Shop Drawings, Product Data, and Samples.

B. Related Sections:
1. Section 01 2900 - Payment Procedures: Applications for Payment and Schedule of Values.
2. Section 01 3100 – Project Management and Coordination: Coordination Drawings.
3. Section 01 3119 - Project Meetings.
4. Section 01 3200 - Construction Progress Documentation: Contractor's Construction Schedule.
5. Section 01 3310 - Request for Electronic Data.
6. Section 01 4200- References: Permits.
7. Section 01 7700 - Closeout Procedures: Warranty and manufacturer's submittals and closeout submittals.

1.3 SUBCONTRACTORS/MATERIALS LIST

A. **General:** Promptly after Contract award, but not later than the Pre-Construction Conference specified in "Section 01 3119 - Project Meetings," submit a list of proposed subcontractors and materials. Include suppliers of items specially fabricated for the Project, such as architectural woodwork.
1. Provide the names and addresses of all subcontractors and special fabricators. Indicate the portions of work to be performed by each, and a preliminary value of the work of each.
2. Identify major standard materials and equipment by manufacturer's name, brand and model.
3. Subcontractors and suppliers named in the subcontractors/materials list will be approved or disapproved in accordance with the conditions of the Contract.

1.4 SUBMITTAL SCHEDULE

A. **Requirements:** After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals in accordance with General Conditions. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.
1. Schedule shall be an integral component of the Project Management Software described in "Section 01 3200 - Construction Progress Documentation".

B. **Preparation:** Prepare the schedule in chronological order. Provide the following

information:
1. Description of work and Section number.
2. Scheduled date for the first submittal of each item.
3. Submittal category (Shop Drawing, Product Data or Sample).
4. Scheduled date for Architect's final release or approval.

C. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Revise and reissue the schedule after each meeting or activity, where revisions have been recognized or made.

1.5 ELECTRONIC SUBMITTAL PROCEDURES

A. Summary:
1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using Submittal Exchange (www.submittalexchange.com) or equal pre-approved website service designed specifically for transmitting submittals between all construction team members.
2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

B. Procedures:
1. Create submittal log in Submittal Exchange by inserting required submittals listed in individual specification sections.
2. Submittal Preparation - Contractor may use any or all of the following options:
   a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
   b. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via email.
   c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
3. Printed Submittals: Provide two printed sets of submittals for shop drawings for structural framing in addition to electronic submittals.
4. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
5. Contractor shall transmit each submittal to Architect using the Submittal Exchange website, www.submittalexchange.com.
6. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
7. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
8. Submit paper copies of any reviewed submittals not submitted electronically at project closeout for record purposes in accordance with Section 01 77 00 –Closeout Procedures.

C. Costs:

1. General Contractor shall include the full cost of Submittal Exchange project subscription in their proposal. This cost shall be included in the Contract Amount. Contact Submittal Exchange at 1-800-714-0024 x1 to verify cost prior to bid.
2. The intent is for Submittal Exchange service cost to be in lieu of postage or shipping costs typically paid for paper submittals. Service cost is a net cost savings to Contractor because submittals sent electronically do not need to be shipped physically.
3. After award of contract, training will be provided by Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.
4. Internet Service and Equipment Requirements:
   a. Email address and Internet access at Contractor's main office.
   b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

D. Products:

1. Basis of specification is Submittal Exchange website system for electronic construction submittals (www.submittalexchange.com) or equal.
2. Substitution may be considered if submitted prior to bid date for pre-approval. Product requirements:

   a. Independently hosted, web-based system for automated tracking, storage, and distribution of contract submittals, Requests For Information, and other contract related documents. FTP sites, e-mail exchanges, and server-based systems hosted from inside a contractor's office will not be considered and are not acceptable.
   b. Utilize 256-bit SSL encryption and hosted at SAS70 Type II compliant data centers.
   c. Minimum five years documented experience of use on comparable commercial construction projects. "Comparable commercial construction projects" shall be defined as documented use on a minimum of five hundred governmental, public-entity, or private sector projects each of $1 million construction value or greater.
   d. Minimum five years documented 99.5% website uptime.
   e. Unlimited individual user accounts and system access for all project subcontractors, general contractor, owner staff, architect, design consultants, and sub-consultants, with no additional fees for those parties to access the system.
   f. Separate locations for owner, architect, design consultant, and sub-consultant review comments with contractors restricted from viewing comments until final review or release by owner or primary design consultant.
   g. Full version histories and dates of exchanges automatically tracked and available for viewing, searching, and reporting in a linear log format compatible with AIA G712.
   h. Functionality to group submittals as required packages and apply forms and review comments to entire package simultaneously.
   i. Functionality for integrated online PDF viewing and review, including graphical markups and stamps, for owner, architect, design consultants, sub-consultants, and general contractor without need for additional software purchase.
   j. Automatic, configurable email notifications for each project team member for new and reviewed submittals and other items.
   k. Automatic, configurable email reminders of past due items.
   l. Customized, automated PDF form generation for submittals, RFIs, and other documents matching standard templates used by owner, design consultants, sub-consultants, and general contractor. Documentation and demonstration of automatic form generation using each entity's templates must be submitted as part of any substitution request.

m. Prior to project start, system vendor shall create submittal log with all required items from project manual or submittal register. Owner or primary design consultant shall have full control over required items list and access to edit, add, or remove items during project.
n. System vendor shall provide minimum one-hour live web meeting training sessions to contractors, design consultants, sub-consultants, and owners staff prior to project start.
o. System vendor shall make available minimum thirty-minute live web meeting training sessions for subcontractors at least twice weekly for the entire duration of the project.
p. System vendor shall provide access for owner, design consultants, sub-consultants, general contractor, and subcontractors to live technical support by phone and email minimum of 7 AM to 6 PM CST on standard business days at no additional cost.
q. Allowance for scanning and printing services provided by local third-party reprographic vendor to assist with obtaining documents electronically and online print ordering.
r. At completion of project closeout, system vendor shall provide minimum of four archival discs that include all documents and tracking logs, or the ability to download this information from the live website in a single complete archive package.

1.6 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES SUBMITTAL PROCEDURES

A. General: Prior to submission to Architect, all Shop Drawings, brochures, Samples and other submissions shall be approved by the Contractor for compliance with the Contract Documents and shall be checked for quantity, size and dimensions by Contractor's personnel. Architect will answer questions raised by the Contractor or subcontractors and will make all determinations regarding quality of materials and equipment, arrangement, and color selections but will not be responsible for quantity, size or dimensional errors. In cases of omissions and obvious error, and in cases of conflict either between details on Contract drawings, or Specifications such questions shall be called to Architect's attention, and the Architect shall give prompt answers to such questions.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
1. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
2. Allow not less than 15 working days for initial review. Allow additional time if submittal is voluminous or if processing must be delayed to permit coordination with subsequent submittals. The Architect will advise the Contractor when a submittal being processed must be delayed for coordination or because of volume of material to be reviewed.
3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

4. If resubmittal is necessary, process the same as the initial submittal. Identify in writing any changes, which have been made other than those directed by markings by the Contractor, Architect, or Architect's consultant on the prior submittal.
5. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 working days for initial review of each submittal.
6. Allow not less than 15 working days for processing each resubmittal.
7. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
8. Perform work for which Architect's approval of Shop Drawings, Product Data and Samples is required only with the use of such items, which have been approved.

D. Submittal Preparation: Identify each submittal with a permanent label, title block, or contractor's stamp. Include the following information:

1. Project name.
2. Date.
3. Name of Architect, Contractor and subcontractor.
4. Name of supplier and manufacturer, as applicable.
5. Number and title of appropriate Specification Section.
6. Drawing number and detail references, as appropriate.

E. Contractor's Review: The Contractor shall approve submittals as required by General Conditions prior to submission to the Architect, and shall stamp and initial each submittal as evidence of Contractor's review and approval. Submittals received without the Contractor's executed approval stamp will be returned by the Architect without action.

F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a cover letter or transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1. On the letter or transmittal record relevant information, requests for data, and deviations from Contract Document requirements, including minor variations and limitations.
2. Include Contractor's certification that information complies with Contract Document requirements.

G. Submittals for Architect's Information: Where Specifications require submittals “for record purposes”, “for information only”, or similar wording, submit two copies of required items. Such submittals will not be stamped or returned by the Architect.

H. Architect's Action: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked to indicate the action taken.

1. Allow 4-inch by 6-inch space to accommodate stamp.
2. Except for submittals for record, information or similar purposes, the Architect will review each submittal, mark to indicate action taken, and return promptly.
3. Architect's review and action on any submittal does not relieve Contractor from responsibility for compliance with Contract Documents requirements, unless deviation is approved in writing.

1.7 SHOP DRAWINGS

A. Format: Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Use of Architect's drawings or computer generated information as Shop Drawings is expressly prohibited. Standard information prepared without specific reference to the Project is not considered Shop Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.

B. Submittal Copies: When requested by Architect, submit seven (7) copies plus additional copies necessary for Contractor's distribution. The Architect will retain two copies, and will return the other marked with action taken and corrections or modifications required.

C. Distribution: Contractor shall make necessary distribution copies from stamped and reviewed reproducible print. Distribute approved Shop Drawing prints as follows:

1. Contractor's file.
2. Job site file.
3. Record documents file.
4. Subcontractors, suppliers, fabricators and installers, as needed.

D. Coordination Drawings: Special Shop Drawings to show the relationship of construction elements that require coordination during fabrication and installation to fit in the space available and to function as intended.

1. Preparation of coordination drawings is specified in "Section 01 3100 - Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
2. Coordination drawings may be prepared by the Contractor, or by an entity responsible for one of the elements involved, or by an entity engaged by the Contractor for the purpose.

1.8 PRODUCT DATA

A. Format: Collect Product Data into a single submittal for each system and element of construction. Product Data includes printed information such as manufacturer's product descriptions and installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information.
2. Do not submit Product Data until compliance with the Contract Documents has been verified.

B. Submittal Copies: When requested by Architect, submit seven copies plus additional copies necessary for Contractor's distribution. The Architect will retain two copies, and will return the others marked with action taken and corrections or modifications required.

C. Distribution: Distribute copies of final Product Data same as specified for Shop Drawings.

1.9 SAMPLES

A. Format: Submit physical Samples which are identical to the material or product proposed, for visual review of kind, color, pattern, and texture, and for evaluation of the actual component as delivered and installed.

1. Architect will not review Samples for requirements such as composition, strength, material class or grade, and similar qualities not apparent upon visual examination.
2. Submit multiple units (not less than 2), to show approximate limits of expected variations in color, pattern, texture or other characteristics.

3. Refer to other Specification Sections for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

B. Preliminary Samples: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

1. Remove or clearly identify choices, which are "extra cost" selections with respect to the Contract requirements.
2. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.

C. Submittal Copies: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit three (3) sets; one will be returned marked with the action taken. Maintain approved Samples at the Project site, for quality comparisons throughout the course of construction.

D. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work.

E. Field Samples: Field Samples (mock-ups) are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.

1. Where required, Field Samples are specified in individual specification Sections.
2. Use confirming letters or transmittal forms to provide a record of activity.

F. Permanent Work: Items incorporated in the Work shall match approved Samples.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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DOCUMENT 01 3310 - REQUEST FOR ELECTRONIC DATA

To: Sizeler Thompson Brown Architects
300 Lafayette Street, Suite 200
New Orleans, LA 70130

Attention: _____

From: _____
Name

_____
Title

_____
Company (General Contractor Only)

(Noted below as "Contractor")

Date of Request: _____

Project Title: _____

Sheets Being Requested:

_____

_____

The above data sheets have been requested by the General Contractor in electronic format for its convenience and use in the preparation of shop drawings related to the subject project. The General Contractor agrees to pay the Architect a "service fee" charge of $150.00 per drawing and the use of these electronic files are subject to the following terms and conditions:

1. Sizeler Thompson Brown Architects' files are compatible with AutoCAD 2009. Sizeler Thompson Brown Architects does not make any representation that these files are compatible with the Contractor's hardware or software beyond the specified release of the referenced software.

2. Data contained on these electronic files are considered a part of Sizeler Thompson Brown Architects' Instruments of Service and shall not be used by the Contractor, or anyone else receiving this data through or from the Contractor, for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to Sizeler Thompson Brown Architects its officers, directors, employees, agents or subconsultants. To the fullest extent permitted by law, the Contractor agrees not to assert any claim and hereby waives any claim or cause of action of any kind or nature against Sizeler Thompson Brown Architects, its officers, directors, employees, agents or subconsultants which may arise out of or in conjunction with the Contactor's use of these electronic files.

3. To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless Sizeler Thompson Brown Architects from all claims, damages, losses and expenses, including attorney's fees, arising out of or resulting from Contractor's use or reuse of these electronic files.

4. These electronic files are not construction contract documents. Significant differences may exist between these electronic files and corresponding hard copy construction contract documents due to addenda, change orders or other revisions. Sizeler Thompson Brown Architects makes no representation regarding the accuracy or completeness of the electronic files received. In the event that a conflict arises between the hard copy construction contract documents prepared by and signed and sealed by Sizeler Thompson Brown Architects and the electronic files, the signed and sealed hard copy construction contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By use of these electronic files, the Contractor is not relieved of his duty to fully comply with the contract documents, including without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate work with that of other contractors for the project.

5. Because of the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, Sizeler Thompson Brown Architects reserves the right to remove all indicia of its authorship, firm identification and/or architectural seal for each electronic display.

6. Under no circumstances shall delivery of the electronic files for use by the Contractor be deemed a sale by Sizeler Thompson Brown Architects and Sizeler Thompson Brown Architects makes no warranties, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall Sizeler Thompson Brown Architects be liable for any loss of profit or any consequential damages from the use or reuse of these electronic files.

The above represents the agreement between the Contractor and Sizeler Thompson Brown Architects with respect to the use of the subject electronic files.

The General Contractor acknowledges his agreement with the above by signing on the acceptance line below and returning this form, with payment of the service fee charge to the office of Sizeler Thompson Brown Architects.

Enclosed service payment: $_____.00 associated with _____Data Sheets @ $150.00 per sheet

ACCEPTED THIS _____ DAY OF _____, 20____.

_____ _____
Signature Title

END OF DOCUMENT

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and –control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

C. Design Performed by the Contractor as called for by the Technical Specifications.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances.

Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

J. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

K. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 REFERENCE STANDARDS

A. Reference Standards – General:

1. Comply with edition of standard in effect as of:
   a. Date of contract documents
2. Compliance with standards which are revised or reissued after that date will not be required unless incorporated into the contract documents by modification.

3. Where applicable codes, laws, or regulations require editions of different dates, obtain instructions from the governing authorities as to which edition is required.

B. The requirements of reference standards are binding on the contractor, just as if they were copied into the contract documents, but no provisions of reference standards shall alter the contractual relationship of the parties to the contract.

1.5 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan, if required.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare a schedule in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Enumeration of results required.
7. Number of tests and inspections required.
8. Time schedule or time span for tests and inspections.
9. Number, type, and requirements for obtaining samples.
10. Unique characteristics of each quality-control service.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager shall not have other Project responsibilities.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
4. Independent testing agencies, whether employed by the Owner or the Contractor, may not change the requirements of the contract documents and may not approve any portion of the work.
5. Employment of testing agencies, by the Contractor or the Owner, shall not relieve the Contractor of his obligation to perform the work in accordance with the contract documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition

to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.10 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
      1) Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

2) Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

M. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:
1. Typical classroom.

1.11 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor’s responsibility: Tests and inspections are Contractor’s responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies 5 working days prior to the commencement or completion of work which is to be tested or inspected and confirm at least 24 hours in advance of time when testing or inspecting is to be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment

installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Submit written report of each original test with each retest.
6. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
7. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and in Statement of Special Inspections prepared for this project, as specified in Division 01 Section "Testing Laboratory Services" and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

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SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. General definitions for Specifications and other Contract Documents including the Drawings.
2. Specification format and content explanation.
3. Explanation of Industry Standards.

1.3 DEFINITIONS

A. **General:** Basic Contract definitions are included in the General and Supplementary Conditions.

B. **"Indicated":** Shown, noted, inferred, scheduled and specified on the Drawings and/or in Specifications.

C. **"Regulations":** Laws, statutes, ordinances and lawful orders issued by authorities having jurisdiction.

D. **"Furnish":** Supply and deliver to the project site.

E. **"Install":** Unload, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean and perform similar operations at the project site.

F. **"Provide":** Furnish and install, complete and ready for the intended use.

G. **"Installer":** An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
1. The term experienced, when used with the term Installer, means having a minimum of 5 previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
2. Trades: Using terms such as carpentry does not imply certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
3. Assigning Specialists: Certain Sections of the Specifications require specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor

has no option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

H. "Project Site": The space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

I. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.4 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 48 Division format and the MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
   a. The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.

1.5 INDUSTRY STANDARDS

A. Applicability of Standards: Except where Contract Documents include more stringent or specific requirements, industry standards, which are referenced in the Specifications are made a part of the Contract Documents and have the same force and effect as if bound or copied directly into Contract Documents.

1. Where requirements are expressed in SI (metric) units, it is understood that corresponding metric versions of industry standards, if available (such as ASTM A 36M for steel members or ANSI B18.22M for steel washers) will be the applicable standards.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a

decision before proceeding.

C. Publication Dates: Where a date of issue or edition is not specified, comply with standard in effect on the date of Contract Documents.

D. Conflicting Requirements: Where compliance with 2 or more standards are specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different but apparently equal and uncertainties to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

E. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

F. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Generally recognized acronyms or abbreviations are used in the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 01 4529

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Selection and payment.
2. Submittals.
3. Contractor's responsibility.
4. Additional tests.
5. Rejection of materials.

B. Related Sections:
1. General Conditions and Supplementary Conditions for Testing laboratory requirements.
2. Division 01 "Construction Project Documentation: for scheduling of required tests and inspections.
3. Division 01 "Quality Requirements" for quality standards and scheduling requirements of testing and inspection.
4. Division 01 "Closeout Procedures" for Project record documents.

C. Requirements for Testing or Inspection: Specific testing or inspection service requirements are specified in the appropriate Sections of Divisions 2 through 48.

1.3 SELECTION AND PAYMENT

A. Selection and Payment of Testing Laboratory:
1. Owner's Responsibility: The Owner will select and pay for an independent Testing Laboratory of recognized standing for all testing herein indicated in the Contract Documents to be the responsibility of the Owner.
2. Contractor's Responsibility: The Contractor will select and pay for an independent Testing Laboratory of recognized standing for all testing hereinafter specified and/or required in the Contract Documents, unless noted otherwise as the Owner's responsibility.
   a. The Contractor shall pay the Testing Laboratory costs for all tests that indicate nonconformance with the Contract Documents.
3. The contractor is to select the testing lab from Owners list of approved Testing Laboratories and pay for all concrete design mix testing.

1.4 SUBMITTALS

A. The independent testing agency shall submit reports and inspections as specified in Division 01 "Quality Requirements".

1.5 CONTRACTOR'S RESPONSIBILITY

A. Contractor's Responsibility: Employment of the Laboratory does not relieve the Contractor of responsibility to provide materials and construction in conformance with the Contract Documents. Processing or use of specified materials shall be understood as constituting full acceptance and approval by the Contractor of materials as suitable for the intended purpose, unless previous written exception is taken by the Contractor.

1. Contractor shall provide and maintain a "hot box" for storage and curing of concrete test cylinder on the project site in accordance with the requirements of the selected testing laboratory.

B. Contractor is responsible for testing requirements as stipulated in the contract documents, as listed in each individual specification and as required by authorities having jurisdiction.

C. Vibration monitoring:

1. The contractor shall provide an independent testing laboratory to perform vibration monitoring at locations throughout the project to monitor any vibrations or movements which may be caused by construction activity.
2. The Contractor shall be responsible for staying in close contact with the monitoring technician(s) to insure that the vibrations do not exceed acceptable limits. It shall be the Contractor's responsibility to make sure that a sufficient amount of vibration readings are taken for his use and for any potential claims due to construction.
3. The vibration monitoring shall be conducted by a testing laboratory having the appropriate experience, equipment, and credentials required of this service. All costs for providing vibration monitoring shall be paid by the Contractor to the testing laboratory. There will be no direct payment to the Contractor for this item of work.

1.6 ADDITIONAL TESTS

A. Additional Tests: The Architect and Owner reserve the right to require additional tests to those specified or upon materials not already specified for testing. If such tests disclose noncompliance with the Contract requirements, the Architect and Owner reserve the right to require additional tests at the expense of the Contractor.

1. All retesting of non-compliant materials shall be at the expense of the Contractor.

1.7 REJECTION OF MATERIALS

A. Notification: The Laboratory shall notify the Contractor, or his authorized representative, of any materials or work which are not in full conformance with the Contract Documents and the Architect shall be informed of such notification. Such nonconforming items shall not be incorporated in the finished work unless changed or corrected.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, security and protection facilities, pedestrian and vehicular access and traffic control.

B. Unless indicated to be optional, temporary services and facilities are Contract requirements.

C. Relocate and rearrange temporary services and facilities as necessary for efficient, orderly progress of the work and to accomplish the required construction.

D. Related Sections:
1. Division 01 "Temporary Storm Water Pollution Control" for the prevention of flooding by runoff of storm water from heavy rains.
2. Division 01 "Temporary Project Signage."
3. Division 01 "Field Engineering" for progress cleaning requirements.
4. Division 01 "Closeout Procedures" for final cleaning requirements.
5. Divisions 02 through 48 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
6. Division 03 "Concrete Paving"
7. Division 07 "Building Insulation"
8. Division 09 "Gypsum Board"
9. Division 31 "Earthwork."
10. Division 31 "Termite Control" for pest control.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel. Submit within 10 days after the effective date of the Notice to Proceed.

B. Implementation and Termination Schedule: Within 10 days after the effective date of the Notice to Proceed with the Contractor's construction schedule, submit a schedule indicating installation and termination of each temporary utility.

C. Site Utilization Plan: Submit a site utilization plan indicating locations of temporary construction fencing, barricades, temporary buildings, lay-down areas, vehicle circulation, and construction site entrances. Show temporary utility lines and connections. Submit within 10 days of the Notice to Proceed.

D. Traffic Plan: Provide plans, details and the amount of traffic on the road that will occur on the proposed traffic plan indicating routes and alternate routes as necessary.

E. Fire Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

F. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water (if applicable) and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.6 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
1. New Orleans Parish, regulations and requirements.
2. Building code requirements.
3. Health and Safety regulations.

4. Utility company regulations.
5. Police, fire department and rescue squad rules.
6. Environmental protection regulations.
7. LDEQ; EPA; OHSA; etc, as required.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

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

B. Pile Driving: Contractor shall notify Owner of pile driving hours and receive Owner's approval. Contractor shall comply with all governing codes and ordinances related to pile driving operations.

C. Staging Areas: The Contractor and subcontractors shall locate offices, parking, materials storage, equipment storage, maintenance areas and similar major facilities in permitted areas directed by the Owner.

1. If offsite areas are required in addition to the staging areas allotted on Drawings, the Contractor shall secure and pay for at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. First Aid Supplies: Comply with governing regulations.

B. Pavement: Comply with Division 03 Section "Concrete Paving."

C. Chain-Link Fencing: Contractor's Choice, system may be portable. Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide green vision intrusion/wind screen at the entire perimeter.

D. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

E. Gypsum Board: A minimum of 5/8-inch thick by 48-inches wide by maximum available lengths; panels with tapered edges as specified in Division 09 Section "Gypsum Board."

F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively. As specified in Division 07 Section "Building Insulation."

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 12 individuals, minimum. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square, minimum, tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
7. The General Contractor must provide a dedicated area in the site trailer for storage and maintenance of electronic-based checklist verification equipment system.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment and System: Prior to the use of permanent HVAC system, provide well vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control prior to the use of the Owner's permanent HVAC system. Provide special care to the permanent system and comply with the following requirements:

1. Permanent HVAC System: Provide filter with MERV of 12-14 at each return air grille in system and replace weekly during the renovations. The filter shall have the following characteristics:
   a. Arrestance: 99 percent.
   b. Efficiency: 80-90 percent.
   c. Types of Filters: Pleated MERV 13 Nordic Pure Filters to comply with LEED requirements.
   d. Tested Contaminant: Legionella, Humidifier dust, smoke, copier toner, rigid cell filters, face powder, paint pigments, insecticide ducts.
2. Use of gasoline-burning space heaters, open-flame heaters or salamander type heating units are prohibited.

3. Temporary Heating Units: Units shall be listed and labeled for type of fuel consumed, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
4. At completion of Construction, provide maintenance, including but not limited to the following: cleaning the HVAC equipment, ductwork and replace of filters prior to occupancy.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Follow any direction as indicated on the plans and as designated by Architect. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. The Contractor shall provide and maintain construction fences, barricades, warning lights and temporary sidewalks as required by the Department of Public Works and other authorities, in approved locations providing complete protection to the public and to provide security to the premises during the construction period. The Contractor shall provide all necessary precautions to insure pedestrian access to adjacent properties during construction. As required, flashing lights shall be installed at locations required by local authorities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service and prepare for connection to the permanent service for the building.
1. Arrange with utility company, Owner, Owner's Program Manager and Architect for time when service can be interrupted, if necessary, to make connections for the temporary services.
2. Contractor is responsible for providing any temporary heating, cooling or ventilation necessary for the construction operations.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
1. Contractor shall provide piping, hoses, backflow preventers, valves and other items necessary to conduct water from connection point to the construction location.
2. Contractor shall supervise use of water to prevent waste and prevent damage to the building and site due to leaking and uncontrolled discharge.
3. Sterilize temporary water piping prior to use.

4. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

D. Sanitary Facilities: Provide temporary toilets, wash facilities and drinking water for use of construction personnel. Comply with authorities having jurisdiction and health codes for type, quantity, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs and obscured from the public view to the greatest extent possible.
1. At a minimum the portable sanitary facilities shall be cleaned, deodorized, and disinfected each day construction is in progress, at the Contractor's expense. If toilets of the chemically tested type are used, at least one toilet will be furnished for each 20 men, in addition to the local jurisdiction and health code requirements. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.
2. Provide toilet tissue, paper towels and similar disposable materials for each facility within construction areas. Provide covered waste containers for disposed material.

E. Heating and Cooling: Provide temporary heating and cooling for the construction activities for curing or drying durations required of the completed installations. Provide the protection of the installed construction by producing a conditioned space. Select heating and cooling equipment that will not have a harmful effect on the completed construction.

F. Ventilation and Humidity Control: Provide temporary ventilation and humidity control for the construction activities for curing or drying durations required of the completed installations. Provide the protection of the installed construction by producing a conditioned space. Select ventilation and humidity control equipment that will not have a harmful effect on the construction. Coordinate ventilation and humidity control requirements to produce the ambient condition required.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
1. Install electric power service as indicated on the drawings.
2. Contractor shall provide extension cords, wiring, switches, disconnects, fuses, lamps and receptacles, and other items necessary to conduct electricity from connection point to the construction location.
3. Contractor shall supervise use of electricity to prevent waste, to prevent injury and damage to the building due to improper and unsafe use including but not limited to overloading and absence of grounding.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.

2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect's office.
   e. Engineer's office.
   f. Owner's office.
   g. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone for use when away from field office.

J. Temporary Exhaust Fans: For construction where dust, dirt, etc. is created or accumulated, fans will be required in each area under construction and run continuously during working hours. Exhaust fan of portable type, shall be exhausted to exterior. Fan shall be minimum 36-inch diameter powered by a 1/3 horsepower motor. Provide wire guard on interior side of units.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30-feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities. Repair and replace any existing site improvements damaged.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary and designated areas of parking for construction personnel. Comply with designated areas and the protection of the site.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Comply with Division 31 Section "Dewatering."

E. Project Identification and Temporary Signs: Provide project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Project Identification Sign: Provide as specified in Division 01 Section "Project's Identification Sign".
2. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction and with Division 01 Section "Field Engineering" for progress cleaning requirements.

G. Lifts and Hoists: Provide equipment necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Temporary Stairs: Until permanent steps are available, provide temporary stairs where ladders are not adequate.

I. Temporary Use of Permanent Stairs and Ramps: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance at Substantial Completion.

J. Sheet Piling: In addition to work specified, provide sheet piling as required. Type, thickness, shoring, bracing and other details shall be the Contractor's sole responsibility and determined by the Contractor as necessary due to excavation depth, soil conditions, rain fall, adjacent traffic and other related factors.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and adjacent to the project, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction by means and methods that comply with the environmental regulations. Minimize possible air, waterway, and subsoil contamination, pollution or other undesirable effects, during the construction duration.
1. Comply with work restrictions specified in Division 01 Section "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion, discharge of soil-bearing water runoff and airborne dust to the site and adjacent properties and walkways, according to requirements of authorities having jurisdiction. Any erosion and diverging of water is the responsibility of the Contractor. Provide maintenance and fill as required to obtain proper erosion control.

D. Storm Water Control: Comply with authorities having jurisdiction and as specified in Division 01 Section "Storm Water Pollution Prevention Plan." Provide barriers in and around the excavation and sub-grade construction to prevent flooding by runoff of storm water from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located outside of the tree's drip line to protect trees and vegetation from damage due to the construction operations. Protect tree root systems from damage, flooding, and erosion. Protect all existing trees not in conflict with new construction.

F. Pest Control: Engage pest-control service to provide practices to minimize attraction and harboring of rodents, roaches and other pests. Pest-control services shall perform extermination and control procedures at regular intervals so Project will be free of pests and their residues during the construction duration to Substantial Completion. Obtain extended warranty for Owner. Control operations lawfully, using environmentally safe materials. Coordinate with Division 31 Section "Termite Control."

G. Site Enclosure Fence and Lock-Up: Before the construction operation begins, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except at the entrance gates.
1. Extent of Fence: As required to enclose the entire Project site or portions of the site determined sufficient to accommodate the construction operations.
2. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security. Maintain security by limiting number of keys and restricting the distribution to authorized personnel. Provide Owner with one set of keys.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and flashing lighting.

I. Temporary Enclosures: Provide temporary enclosures for protection of the construction in progress and completed. Protect the construction from exposure, foul weather, other construction operations and similar activities. Provide temporary weathertight enclosure for the building until the building's exterior enclosure is complete and the building is conditioned for the installation of the interior finishes and for permanent conditioning of the building.
1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

J. Temporary Partitions: As required, provide floor-to-ceiling dustproof partitions to limit dust and dirt migration from other areas and as required for code compliance.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side
   a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48-inches between doors. Maintain water-dampened foot mats in vestibule.
2. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weather strip at all openings.
6. Provide walk-off mats at each entrance until Substantial Completion.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Prohibit smoking in construction areas, only allowed in designated areas, refer to Division 01 Section "Summary" for compliance with LEED requirements (if applicable).

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review with the local fire department and establish procedures to be followed, instruct personnel and post warnings and prevention/protection information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure, but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.

b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline for the use of the temporary facilities. To minimize waste and abuse, limit the availability of temporary facilities for essential and intended uses.

B. Maintenance: Maintain the temporary facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis as required to achieve appropriate results and to avoid the possibility of damage.

C. Termination and Removal: Remove each temporary facility when the use of the facility has ended. If necessary, complete or restore permanent construction that has been delayed due to the interference of the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and temporary facilities are property of Contractor. The Architect reserves right to take possession of the Architect's and Project's identification signs.
2. At Substantial Completion, clean and restore the site and permanent facilities used during construction duration. Comply with final cleaning requirements specified in Division 01 Sections "Closeout Procedures" and "Field Engineering."

END OF SECTION

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SECTION 01 5813

TEMPORARY PROJECT SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Project's Identification Sign.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls": Project Identification and Temporary Signs.

1.3 SUBMITTALS

A. Sign Shop Drawings: Submit dimensioned shop drawings of the Project's Identification Sign similar to the example shown at the end of this section for approval. Identify what will be painted and what will be a vinyl sign. Provide paint submittal and colors proposed.

PART 2 - PRODUCTS

2.1 SIGN MATERIALS

A. Construction: Contractor shall provide one (1) sign at locations as indicated on the drawings or as directed by the Architect. Provide one-sided sign as detailed in Part 3.

B. Size: Nominal 4 feet by 8 feet, as detailed in Part 3.

C. Support Structure, Framing and Trim: All lumber and plywood shall be pressure treated, sizes as specified in Part 3 at end of this Section.

D. Paint and Primers: Provide the following:
1. Primer: Provide a minimum of 1 coat as instructed by manufacturer.
   - MOORE: Moore's #169 SuperSpec Latex Exterior Primer
   - PPG: 17-921 Seal Grip Acrylic Primer
   - SW: Loxon Masonry Primer
2. First and Second Coat: Provide intermediate and top coats.
   - MOORE: #170 SuperSpec Latex House and Trim Paint
   - PPG: 78-45 Sun Proof Exterior Semi-Gloss Acrylic Paint
   - SW: A-100 Exterior Semi-Gloss Latex Paint
3. Color: Sherwin Williams SW6524 "Commodore" or approved equal, through the submittal process.

E. Concrete: Concrete for sign post footings shall be minimum of 3,000 psi. Comply with ASTM C 94; ACI 301, "Specification for Structural Concrete"; ACI 117, "Specifications of Tolerances for Concrete Construction and Materials"; and CRSI's

"Manual of Standard Practice."

F. Fasteners: Fasten sign components with stainless steel nuts, bolts and washers, sized as required to mount sign. All other fasteners and accessories shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install project's identification signs within 30 days of Notice to Proceed.

B. Erect project's identification signs in locations as directed by Owner's Campus Representative.

C. Installation: Contractor shall flatten sign as required and fasten sign to supports and framing as detailed in Part 3 at end of this Section.

D. Install signs plumb, level and anchor securely.

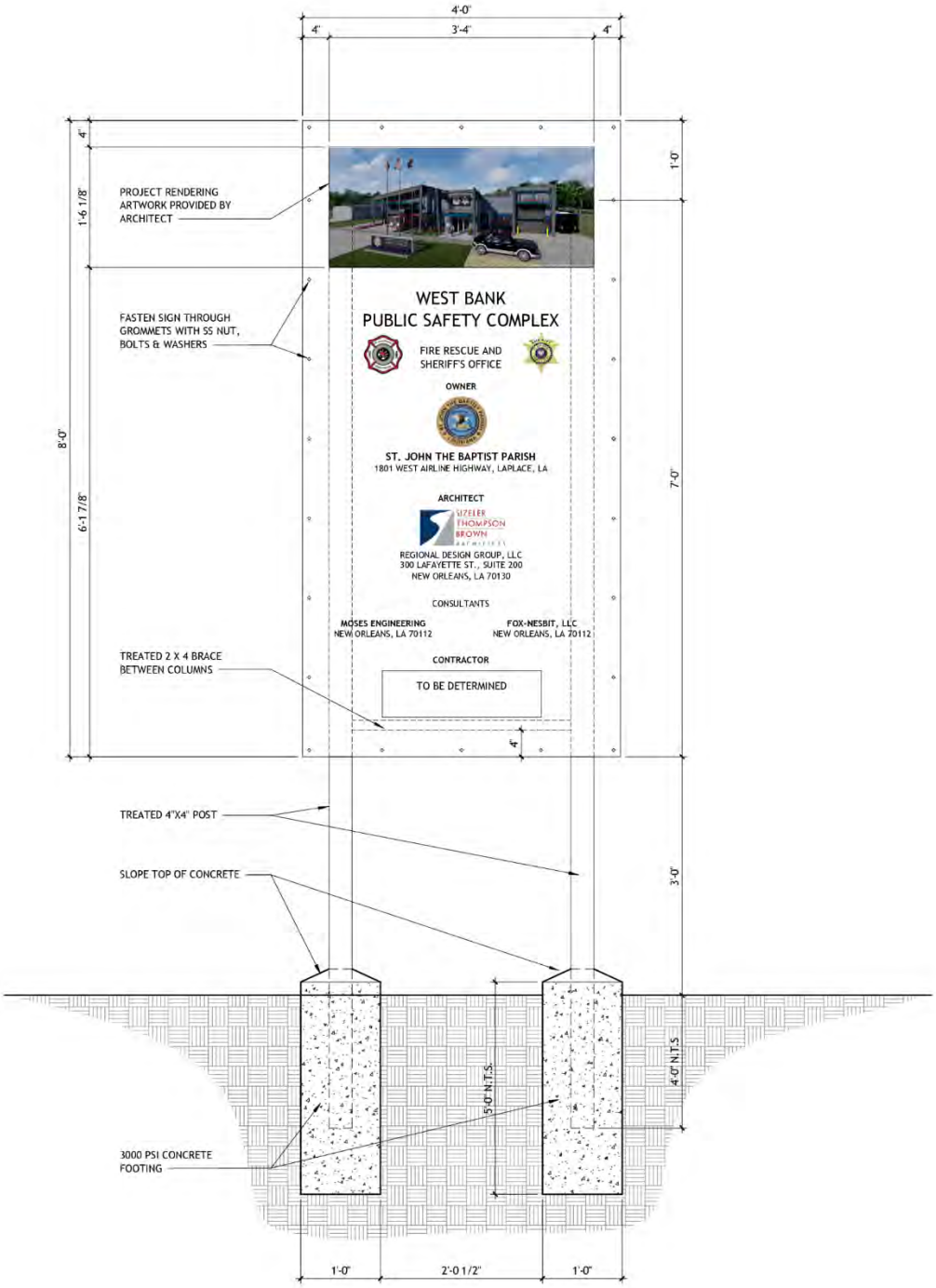
E. Paint all exposed surfaces of the sign, supports, and framing.

3.2 MAINTENANCE

A. Maintain signs and supports and regularly clean throughout the construction, as required. Repair or replace damaged or deteriorated signs during the construction duration as directed by the Architect.

3.3 REMOVAL

A. Remove signs, framing, supports, and foundations at Substantial Completion and restore the site. Return signs to Owner at their request.



PROJECT SIGN

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SECTION 01 5819

ARCHITECT'S IDENTIFICATION SIGN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes:** Architect's Identification Sign.

B. Related Sections:

1. Section 01500 - Temporary Facilities and Controls: Project identification and temporary signs.

PART 2 - PRODUCTS

2.1 SIGN MATERIALS

A. **Graphic Design, Content, Colors, Lettering Style:** Architect will furnish Contractor with one (1) vinyl signs. Contractor shall mount back-to-back on plywood backing and structure in detailed in Section 3.

B. **Sign Size:** Nominal 3 feet by 6 feet - 2 inches.

C. **Support Structure, Framing, and Trim:** All pressure treated, sizes as specified on sign detail at end of this Section.

D. **Paint and Primers:** Exterior quality, gloss alkyd enamel, two coats, paints shall be approved by Architect.

1. One coat primer: Exterior Alkyd Wood Primer:
   a. Sherwin Williams; Exterior Oil Wood Primer, A-100.
2. Two topcoats: Exterior Alkyd Enamel (Gloss): (Gloss Level 6).
   a. Sherwin-Williams; Seaguard 1000 Marine Enamel, Industrial & Marine.
   b. Color shall be Sherwin Williams SW 6524 "Commodore" or approved equal.

E. **Concrete:** Concrete for sign post footings shall be minimum 3,000 psi. Comply with ASTM C 94; ACI 301, "Specification for Structural Concrete"; ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"; and CRSI's "Manual of Standard Practice."

F. **Fasteners:** Fasten sign with stainless steel screws and stainless steel cup washers. All other fasteners and accessories shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. **Install Architect's identification signs** within 30 days after date fixed by Notice to Proceed.

B. Erect Architect's identification signs in locations as directed by Architect.

C. **Installation:** Contractor shall roll out Architect's vinyl sign and mount sign to supports and framing as detailed on the sketch at end of this Section.

D. **Install signs** plumb and level. Anchor securely.

E. **Paint all exposed surfaces of sign,** supports, and framing according to manufacturer's and as specified above.

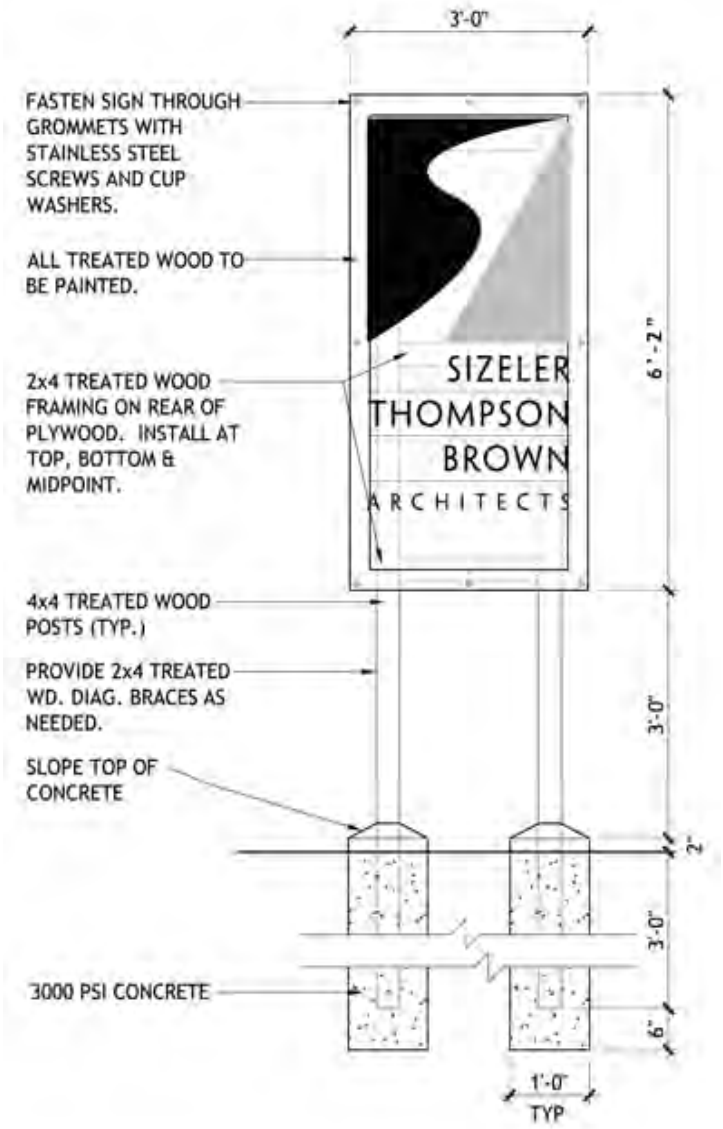
F. Site Signage shall be restricted to the Architect's Identification sign, the Owner's project sign provided by and installed by contractor. Contractor's identification signs or banner (not to exceed 100 Square Feet, total). Identification signs required by code for plumber and electrical (not to exceed 2 feet by 2 feet for each trade). No other signs or banners permitted without written permission of the Architect.

3.2 MAINTENANCE

A. **Maintain signs** and supports and keep clean. Repair damage. Replace deteriorated signs during course of project as directed by Architect.

3.3 REMOVAL

A. **Remove signs,** framing, supports, and foundations at completion of Project and restore the area. Return vinyl sign to Architect.



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SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:
1. Definitions.
2. Quality assurance: ADA compliance.
3. Product delivery, storage, and handling.
4. Product selection procedures.
5. Hazardous materials.
6. Installation of products.

B. Related Sections include:
1. Section 01 4200 - References: Applicability of industry standards to products specified.
2. Section 01 6300 - Product Substitution Procedures: Requirements for substitution requests made after award of the Contract.

1.3 DEFINITIONS

A. **Definitions:** Terms used in the Drawings and Specifications such as “specialties”, “systems”, “structure”, “finishes”, and “accessories”, which are self-explanatory and have well recognized meanings in the construction industry are not changed by this Section.
1. Products: Items purchased for incorporation in the work, whether produced for the Project or taken from previously produced stock, including “materials”, “equipment”, “systems”, and similar terms.
2. Named Products: Items identified by manufacturer's product name, make or model designation.
3. Materials: Products that are shaped, cut, worked, mixed, finished, fabricated, processed, or assembled to form a part of the work.
4. Equipment: Products with operational parts, whether motorized or manually operated, that usually, but not necessarily, requires service connections such as wiring or piping.

1.4 QUALITY ASSURANCE

A. **Source Limitations:** To the fullest extent possible, provide all products of the same kind from a single source.

B. **Compatibility of Options:** When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with other products.

C. **Labels and Nameplates:** Unless required for evidence of compliance and to display essential operating data, labels and nameplates shall be concealed in the completed construction.

1. Labels: Where required for observation after installation, locate product labels on an accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain essential operating data such as:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.

D. ADA Compliance: Provide products and installation of products to comply with 28 CFR Part 36 "ADA Accessibility Guidelines for Buildings and Facilities". Notify the Architect of any observed conflicts or omissions between the requirements indicated for this project and the ADA Guidelines.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store and handle products in accordance with the manufacturer's recommendations. Prevent damage, deterioration and loss, including theft.

B. Delivery: Schedule delivery to avoid long-term storage at the site and to prevent overcrowding of construction and storage spaces.
1. Deliver products to the site in the manufacturer's original packaging with labels and instructions for handling, storing, unpacking, protecting and installing.

C. Inspection: Inspect products upon delivery to ensure that they comply with requirements and are undamaged and properly protected.

D. Storage: Store products at the site to facilitate inspection and measurement of quantity or counting of units.
1. Store heavy products in a manner that will not endanger the supporting construction.
2. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and (unless otherwise specified or permitted) previously unused.
1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details for complete installation and for the intended purpose.
2. Where available, provide standard product types that have been used successfully in similar situations.
3. As specified in "Section 01 4200 - References", quantity or quality levels shown and specified represent minimum acceptable levels.

2.2 PRODUCT SELECTION PROCEDURES

A. Proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated or an Architect-

approved equal by Addendum prior to receipt of Bids in accordance with the Instructions to Bidders. No substitutions will be permitted after award of the Contract except as provided in "Section 01 6300 - Product Substitution Procedures."

1. Quality Standards: Proprietary specifications are used only to denote the quality standard of the products desired, and do not restrict Bidders to the specific brand, make, manufacturer or specification named. Proprietary specifications are used only to set forth and convey to prospective Bidders the general style, type, character and quality of the products desired. Equivalent products will be acceptable, but only with written prior approval as described in the Instructions to Bidders.

B. **Reference Standards Specification Requirements:** Where products are specified in accordance with an established standard. Select any product that meets or exceeds those standards.

C. **Descriptive Specification Requirements:** Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a manufacturer's name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

D. **Performance Specification Requirements:** Where Specifications require compliance with performance requirements, with or without use of a manufacturer's name, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. Appropriate overall performance of a product is implied where the product is specified for a specific application.

E. **Compliance with Standards, Codes and Regulations:** Where the Specifications require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified. Refer to "Section 01 4200 - References" for additional provisions.

F. **Visual Matching:** Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

G. **Visual Selection:** Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, the Architect will select the color, pattern and texture.

2.3 HAZARDOUS MATERIALS

A. **Hazardous Materials:** No products containing asbestos shall be used in the construction.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. **General:** Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.
2. Visual Effects: Provide uniform joint width in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

B. **Manufacturer's Instructions:** Comply with manufacturer's installation instructions

and recommendations, which do not conflict with requirements contained in Contract Documents. Obtain Architect's determination in case of apparent conflicts.

C. Preliminary Procedures: Inspect products immediately upon delivery and again prior to installation. Remove damaged and defective items from the Project.

1. Verify measurements and dimensions, before starting each installation.

D. Protection: Install each component during weather conditions and Project status that will ensure against damage and deterioration.

1. Protect products and adjacent construction during and after installation, until acceptance, to prevent damage, soiling and deterioration from subsequent operations, harmful exposure, and incompatible materials.
2. Coordinate the erection of temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for those purposes.

E. Attachment: Where mounting heights are not indicated, install components at standard mounting heights recognized within the industry for the application indicated. Refer uncertain mounting height determinations to the Architect for decision.

1. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for thermal and building movement.

F. Replacement and Repair: Promptly remove damaged, defective and non-conforming products and acceptably replace with new, conforming products.

1. Subject to Architect's approval, damaged and defective products may be repaired to condition equivalent to acceptable new condition. Products that cannot be satisfactorily repaired shall be removed and replaced without additional cost to the Owner.
2. Replacement and repairs shall be made by the party responsible for the original installation.

END OF SECTION

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

C. Requirement for installer certification that they did not use any non-compliant products.

1.2 RELATED REQUIREMENTS

A. Section 01 3300 - Submittal Procedures.

B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

D. Section 01 6000 - Product Requirements.

1.3 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings.
   2. Interior adhesives and sealants, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Exterior and interior paints and coatings.
   2. Exterior and interior adhesives and sealants, including flooring adhesives.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
   1. Concrete.
   2. Clay brick.
   3. Metals that are plated, anodized, or powder-coated.
   4. Glass.
   5. Ceramics.
   6. Solid wood flooring that is unfinished and untreated.

1.4 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; current edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

F. CHPS (HPPD) - High Performance Products Database; Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Carpet and Rug Institute; Current Edition.

H. UL (GGG) - GREENGUARD Gold Certified Products; UL Environment; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

I. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition; www.aqmd.gov.

J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

K. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

L. UL (GGG) - GREENGUARD Gold Certified Products; UL Environment; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.5 SUBMITTALS

A. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

B. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.6 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following;
      a. Current UL (GGG) certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.
      d. Certification by manufacturer that product complies with requirements.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
   2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Joint Sealants: SCAQMD 1168 Rule.
   3. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 6300

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes:** Administrative and procedural requirements for handling product substitutions during bidding and after award of the Contract.

B. Related Sections:
1. Section 01 3300 - Submittal Procedures: Requirements for submitting Submittal Schedule.
2. Section 01 6000 - Product Requirements: Requirements for product selection procedures.
3. Section 01 6310 - Substitution Request Form: Form to be used by Bidder/Contractor for submission of product substitutions before and after award of the Contract.

1.3 LIMITATIONS ON SUBSTITUTION

A. **Substitutions:** Product substitutions will NOT be considered during bidding or after award of the Contract unless the "Substitution Request Form" is used (included in this Project Manual as "Section 01 6310").
1. Substitutions will be acceptable only if the proposed substitute meets all specified requirements, including the manufacturer's specifications for the originally specified product, which were current on the date of the Contract Documents.
2. Proposed substitutions must be approved by both the Architect and the Owner.
3. Requests for substitutions may be considered or rejected at the discretion of the Owner or the Architect.
4. By requesting a substitution, the Contractor warrants the following to the Owner and Architect:
   a. The proposed substitute is equal or superior in all respects, including warranties and guarantees, to the specified product or method.
   b. No additional costs to the Owner or change in time will be involved unless stated in the request.
   c. Necessary coordination with other work will be provided by the Contractor.

B. **Exceptions:** The following are not considered substitutions and are not subject to requirements specified in this section for substitutions:
1. Revisions to Contract Documents requested by the Owner or Architect.
2. Specified options on products and construction methods included in Contract Documents.

1.4 SUBMITTALS

A. **Substitution Request Submittal:** Requests for substitution will be considered only

after compliance with the following:

1. Submit 3 copies of each substitution request form (form shall be completed and signed).
2. Identify the product, or the fabrication or installation method to be replaced, with references to Specification Section and Drawing numbers. Provide complete documentation for the proposed substitution including the following information, as appropriate:
   a. Product Data, including manufacturer's printed recommendations for fabrication and installation.
   b. Samples, where applicable or requested.
   c. Comparison of the proposed substitution with significant qualities of the product originally specified. Significant qualities may include size, weight, durability, performance and visual effect.
   d. Changes or modifications to other parts of the Work necessary to accommodate the proposed substitution.
   e. Effect on the Contractor's Construction Schedule and Contract Time.
   f. Cost information in accordance with procedures for Change Order proposals, if change in the Contract Sum is involved.

1.5 SUBSTITUTIONS REQUESTED DURING BIDDING

A. No substitution will be considered prior to receipt of bids unless written request for approval has been received by the Architect at least **7 WORKING DAYS** prior to the date for receipt of Bids. Such requests shall be submitted on the proper "Substitution Request Form" at the end of this Section and described in as much detail as is reasonable for review of request. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

1. The request will be automatically rejected unless the following conditions are met:
   a. The request is submitted on the required "Substitution Request Form" included in these Specifications.
   b. Extensive revisions to Contract Documents are not required.
   c. Proposed changes are in keeping with the general intent of Contract Documents.
   d. The request is timely, *fully* documented, and properly submitted.

B. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum, as defined in the Instructions to Bidders. Bidders shall not rely upon approvals made in any other manner.

1.6 SUBSTITUTIONS REQUESTED AFTER CONTRACT AWARD

A. Conditions: The Architect's and Owner's evaluation of substitution requests made after Contract is awarded may include the following considerations:

1. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
2. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation, or other considerations of merit, offsetting additional responsibilities to the Owner, which may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate contractors, increased operating and maintenance costs, or similar considerations.
3. The specified product or method of construction cannot be provided within the Contract Time. The request may not be considered if delay from use of the specified product or method results from failure to pursue the Work promptly or coordinate activities properly.

4. The specified product or method of construction is not approved by a governing authority.
5. The specified product or method of construction is not compatible with other materials.
6. The specified product or method of construction cannot be coordinated with other materials.
7. The specified product or method of construction cannot provide a warranty required by the Contract Documents.

1.7 RESPONSE

A. Architect's Action: Within two weeks of receipt of the request for substitution, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on a proposed substitution is not made within the allotted time, use the product or method specified. Acceptance during Construction Phase will be by Change Order if change in Contract Time or Contract Sum is involved. The request will be rejected unless the following conditions are met:
1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of Contract Documents.
3. The request is timely, fully documented and properly submitted.

1.8 SUBMITTALS REQUIRED BY THE CONTRACT DOCUMENTS

A. Non-Complying Submittals: Requests for substitution must be in accordance with Paragraph 1.3 of this Section. The routine submittal of Shop Drawings, Product Data and Samples that represent construction not complying with the Contract Documents does not constitute a request for substitution.

B. Required Submittals: Submittals specified in this Section do not take the place of submittals required in the specification Section under which the substitution is proposed, unless exemption from further submittals is stated in the approval.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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DOCUMENT 01 6310

SUBSTITUTION REQUEST FORM

To: Sizeler Thompson Brown Architects
Regional Design Studio
300 Lafayette Street, Suite 200
New Orleans, LA 70130

Project: St. John the Baptist Parish
Westbank Public Safety Complex
STBA #21238.00

From:_____ **Date:** _____

Specified Item: _____ _____ _____ _____
(Section Number) *(Page Number)* *(Paragraph)* *(Description)*

_____

We believe that the following product is equal or superior to the specified product in appearance, durability, performance, and in every other respect, and we hereby submit it for your consideration as a substitute for the specified item for the above-mentioned project:

A. Proposed Substitution: _____

_____

_____

_____

B. Reason for Substitution: _____

_____

_____

_____

_____

C. COSTS (*Construction Phase Only* - Provide complete breakdown of costs including the cost amount to be DEDUCTED from the Contract Sum if the proposal substitution is accepted. Include documentation for both materials and labor): _____

_____

_____

_____

D. SCHEDULE (*Construction Phase Only* - Describe substitution's affect on construction schedule):

_____

_____

_____

_____

_____

E. Supporting Data:

1. Product Data: Attach complete technical data, including laboratory tests, if applicable.
2. Installation: Include complete information on changes to Drawings and/or Specifications describing the steps that the proposed substitution will require for its proper installation.
3. Samples: Submit with request all necessary samples and substantiating data clearly marked to prove equal quality and performance to that which is specified.

F. **List** ways in which the proposed substitution affects dimensions shown on Drawings: ___

_____

_____

_____

G. **List** effects of proposed substitution on other trades: _____

_____

_____

_____

H. **List** ways in which proposed substitution would be affected by applicable code requirements and agency approval: _____

_____

I. **List** differences between proposed substitution and specified item: _____

_____

_____

_____

J. **Manufacturer's warranties** of the proposed and specified items are: Same __Different__
Explain: _____

_____

_____

_____

K. **List** information on availability of maintenance service and source of replacement materials: _____

_____

_____

_____

_____

L. Certification of, and Assumption of Liability for, Equivalent Performance:
The undersigned states that the function, appearance and quality of the proposed

substitution is equivalent or superior to the specified item and **is in full compliance with the Contract Documents and applicable regulatory requirements. NOTARIZATION IS REQUIRED FOR SUPPLIER DURING BIDDING PHASE. NOTARIZATION IS REQUIRED FOR BOTH SUPPLIER AND CONTRACTOR DURING CONSTRUCTION PHASE. FAILURE TO PROVIDE SIGNED AND NOTARIZED SUBSTITUTION REQUEST WILL RESULT IN AUTOMATIC REJECTION OF PROPOSED SUBSTITUTION**

_____ _____
Supplier *Signature*

_____ _____
Telephone *Date*

Signature must be by person authorized to legally bind his/her firm to the above terms. Failure to provide legally binding signature will result in rejection.

NOTARY:_____

_____ _____
General Contractor *Signature*

_____ _____
Telephone *Date*

NOTARY:_____

A/E's REVIEW AND ACTION (to be filled-in by Architect/Engineer)

- ❑ **Substitution Proposal Rejected because Not Complete**
- ❑ **Substitution Accepted** **By:** _____
- ❑ **Substitution Accepted as Noted** **Date:** _____
- ❑ **Substitution Rejected** **Remarks:** _____
- ❑ **Substitution Rejected Because Request Received Too Late**

END OF DOCUMENT

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SECTION 01 7123

FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
2. Field engineering and surveying.
3. Final As-Built Surveying.
4. General installation of products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. See Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Certified Surveys: Submit two copies signed by land surveyor.

D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

E. Final Surveyed As-Built: Submit 7 hard copies and 1 digital copy as required to receive substantial completion.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated. Those scopes of work and associated

costs indicated in the Contract Documents that require a surveyor are the responsibility of the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner and Architect that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by

field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information (RFI) to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents, Division 01 "Request for Information". Refer to Division 01 "Project Management and Coordination".

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey. Indicate dimensions, locations, angles and elevation of construction and site work.
1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet (2.4m) in spaces without a suspended ceiling, unless indicated otherwise.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other

work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Maintain all public roadways, sidewalks, driveways, etc. in a clean condition during the construction project. All mud, waste material, debris, etc. deposited on said areas by the Contractor shall be removed daily, before the end of work or more frequently, as necessary to maintain a clean condition.

D. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

E. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not

recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation. Adjust Entrances to ensure water and weatherproof integrity of the building and to eliminate any leaking.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 "Cutting and Patching."
1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

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SECTION 01 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements for cutting and patching necessary to:
1. Make connecting portions of Work fit properly;
2. Prepare in-place construction to receive new Work;
3. Restore damaged and defective in-place construction.

B. Related Sections:
1. Division 01 Section "Construction Progress Documentation": Contractor's Construction Schedule.
2. Division 02 Section "Demolition": Demolition of selected portions of the existing buildings for alterations.

C. Related Requirements: Specific requirements and limitations applicable to cutting and patching various kinds of Work are included in the respective technical Sections.

1.3 ARCHITECT'S APPROVAL

A. Architect's Approval: Architect's approval is required prior to cutting and patching which (1) affects structural elements, (2) arises due to previously unknown conditions, and (3) affects visual effect and performance qualities of the completed construction.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Where approval for cutting and patching is required, request and obtain written approval before proceeding. Describe conditions making cutting and patching necessary and outline intended procedures.
1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems

that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will e disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

B. Compliance: Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of Work, which is not in compliance with Contract requirements.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 COORDINATION

A. Coordinate all cutting and patching within the existing building and/or immediately adjacent to occupied areas of the existing building with the Owner.

B. Schedule this work with the Owner in advance to avoid disruption of occupancy.

1. Provide dust control temporary barriers and noise control as required by Owner or other Sections of the Work.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Match adjacent components. If identical materials are not available, use materials that match to the fullest extent possible and whose installed performance will equal or exceed that of original materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Design and provide temporary support of work to be cut and adjacent components to remain.

B. Protection: Protect in-place construction during cutting and patching to prevent damage from operations or from weather exposure. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Coordination: Avoid interference with adjoining areas and interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Perform cutting and patching at the earliest feasible time and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Inspection: Before cutting, examine condition of adjacent surfaces and the work area. Take corrective action before proceeding if necessary to safely perform the work and prevent damage or dislocation of construction to remain.

C. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly

to size required and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete

D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

E. Fire Resistive Construction: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements of local building code, to resist passage of smoke and other gases, and to maintain original fire-resistance rating of construction penetrated.

F. Cleaning: Clean areas and spaces where cutting and patching are performed or used as access. Clean piping, conduit and similar features before they are enclosed or concealed.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes:** Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection and acceptance procedures.
2. Project record document submittal.
3. Operating and maintenance manual submittal.
4. Closeout procedures.
5. Final cleaning.

B. Related Sections:
1. Document 00 7000 – Conditions of the Contract, Jefferson Parish General and Supplementary Conditions.
2. Section 01 4200 – References: Standards, Definitions, and applicability of industry standards.
3. Section 01 3300 - Submittal Procedures: Procedures for submitting copies of Shop Drawings and Product Data for project record documents.
4. Section 01 7800 - Closeout Submittals: Submittal of warranties and bonds.
5. Divisions 02 through 48: Completion requirements for specific construction activities.

C. **The Requirements of this Section** amplify and do not modify provisions of the General and Supplementary Conditions.

1.3 SUBSTANTIAL COMPLETION

A. **Preliminary Procedures:** Before requesting inspection for certification of Substantial Completion, complete the following. **List exceptions in the request.**
1. 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 written notice that the work or designated portion thereof is substantially complete and 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.
2. Advise Architect that project is ready for inspection by the State Fire Marshal's office.
3. Advise Owner of pending insurance change over requirements.
4. Submit signed roofing guarantees and other specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
5. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

6. Submit record documents and other final record information as applicable and required for the project.
7. Deliver tools, spare parts, extra stock and similar items.
8. Make final change over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change over in security provisions.
9. Perform complete start-up testing and balancing of systems and submit reports to the Architect. Instruct the Owner's personnel in proper operation and maintenance procedures.
10. Discontinue and remove construction mock-ups and similar elements.
11. Remove temporary facilities, construction equipment, and temporary services. Restore disturbed items to original condition, or better.
12. Complete final clean up requirements. Touch-up and otherwise repair and restore marred exposed finishes.
13. Submit final meter readings for utilities and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
14. If a Storm Water Pollution Prevention Plan was required, submit a copy of the Completion Report form filled out in its entirety.

B. **Inspection Procedures:** On receipt of a request for inspection, Architect will either proceed with inspection or advise the Contractor of unfilled requirements. Architect will prepare the Recommendation of Acceptance, or advise Contractor of construction that must be completed or corrected before the Recommendation will be issued.

1. Architect will perform inspection when assured that the Work has been substantially completed.
2. Results of the completed inspection will form the basis of requirements of final acceptance.

1.4 PUNCH LIST

A. When Project nears completion, prepare a list of items to be completed or corrected. This list shall be submitted to the Architect for his review, verification and amendment. Incorporate all uncorrected items included on observation reports made by Architect's representative. Submit certificates of inspection from all responsible Regulatory Agencies concurrently with punch list.

B. Punch list items shall be completed prior to release of Special Retainage as indicated in the project requirements. Intermediate request for payment for satisfactorily completed punch list items shall be in accordance with the project requirements.

1.5 FINAL ACCEPTANCE

A. **Preliminary Procedures:** Before requesting final inspection for certification of final acceptance and final payment, complete the following.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final changes to the Contract Sum.
3. Submit properly executed Lien and Privilege Certificate not less than 45 days from Substantial Completion date.
4. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
5. Submit consent of surety to final payment on AIA Form G707.

6. Submit a final liquidated damages settlement statement, if applicable.
7. Submit evidence that taxes, fees and similar obligations have been paid.
8. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Re-inspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including items from earlier inspections, has been completed.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.

C. Additional Requirements: Refer to General Conditions.

1.6 RECORD DOCUMENTS

A. Project Sets: The Contractor **shall maintain three identical sets of record documents.** Do not use record documents for construction purposes; protect from deterioration and loss; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain clean, undamaged sets of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the sets to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most suitable for showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red colored erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Provide a schematic roof plan on which is shown and identified each item of roof-top equipment which requires periodic inspection and/or maintenance, such as exhaust fans, intake/exhaust cowls, roof drains, plumbing vent stacks, air conditioning equipment, and operating equipment of any type. Identification of equipment must match identification used in warranty and submittals (ie: RTU-4, EF-4, etc.)
5. Organize record drawing sheets into manageable sets, bind with durable paper cover sheet, and print suitable titles, dates and other identification on the cover of each set. Sheets must be in same order and quantity as the contract documents. All sheets must be included in the set.
6. Submit a reproducible record set of Contract Drawings and an electronic format set of Contract Drawings. The Electronic format must be in PDF format and each file shall be identified the same as the contract documents. (ie: A201, E305, etc.)

C. Record Specifications: Maintain three complete copies of the Project Manual, including addenda, and three copies of other written construction documents such as Change Orders and modifications issued in written form during construction.

1. Mark these documents to show substantial variations in actual Work performed.
2. Give particular attention to substitutions, selection of options and similar information on elements that cannot be readily identified by direct observation.
3. Note related Record Drawing information and Product Data.
4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain three copies of each Product Data submittal, including items submitted for record purposes. Submit to Architect in the same numbered format and sequence as the contract documents.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted.
2. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations.
3. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation.
4. Note related Change Orders and mark-up of record drawings and Specifications.
5. Upon completion of the Work, submit record Product Data to the Architect for the Owner’s records. Record Product data must be provided for all items requiring product data submittals by the specification, even if it was not submitted during the construction phase.

E. Record Samples: Immediately prior to the date or dates of Substantial Completion, the Contractor shall meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes.

1. Deliver selected Samples to the Owner's storage area. Contractor shall dispose of Samples not selected for Owner's records.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference.

G. Maintenance Manuals: Unless otherwise specified in the Technical Sections, provide 2 sets of maintenance manuals for the project, incorporating all maintenance, repair and operating procedures specified for the project. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.

1. Include the following types of information:
   a. Emergency instructions.
   b. Spare parts list.
   c. Copies of warranties.
   d. Wiring diagrams.
   e. Recommended "turn-around" cycles.
   f. Inspection procedures.
   g. Shop Drawings and Product Data.
   h. Fixture lamping schedule.
   i. Maintenance and repair procedures.
2. Roofing Manuals: The roofing manuals specified in Division 7 shall be provided as one of the required manuals.

H. Submittal: Upon completion of the work, and prior to the awarding of substantial completion. The Contractor transmit all record documents and maintenance manuals to the Architect for the Owner's records. The records must be transferred with an inventory of items provided per each box, roll or container. A master inventory must be provided via electronic format (PDF).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PROJECT CLOSEOUT PROCEDURES – GENERAL SEQUENCE

A. Submit the following initial documentation with a letter indicating that the project is ready for the inspection by the State's Fire Marshal's Office:
1. Life Safety Systems check list for Fire Alarm System.
2. Life Safety System check for Emergency Generator System.
3. Life Safety System for Sprinkler System inspections for underground and or above ground piping systems.
4. Life Safety System check for Fire Dampers. Testing performed by Contractor and witnesses by TAB firm.
5. Life Safety System check for Fire Rated Penetrations and sealing of partitions.
6. Exit lights. Verify proper operation.
7. Door Hardware. Verify proper operation.
8. Testing and Balancing verify installation at various intervals during construction. Submit TAB report prior to acceptance. TAB report must be submitted and approved by Mechanical Engineer before the project is accepted.
9. Submit all inspection reports performed by the Office of the State Fire Marshal during the construction period.
10. Life Safety check for elevators.
11. Inspection by state elevator inspector.

B. After submittal of the initial documentation, the following sequence shall be performed:
1. Architect and Contractor will review documentation submitted and construction status of the project and when determined to be in order and ready for inspection by the Fire Marshal, submit the above listed documentation and Certificate of Completion to the Office of the State Fire Marshal.
2. Fire Marshal Inspection of the project will be scheduled and performed. Fire Marshall will review project and develop and submit Inspection Report.
3. Submit inspection report from states elevator inspector.
4. Contractor shall then submit the Contractor's Punch List to the Architect along with the Fire Marshal Inspection Report and request Substantial Completion.
5. Architect and Engineering Consultant's will perform an inspection to determine Substantial Completion and when determined to be in order and ready for occupancy send Recommendation of Acceptance with Contractor's punch list and Design Team punch list to the owner.
6. A prerequisite to the work being accepted as Substantially Complete is the Owner's receipt of the executed Roofing Contractor's and Roofing Manufacturer's guarantees.
7. TAB report must be submitted by the Contractor and approved by Mechanical Engineer before the project is accepted.
8. Prior to Substantial Completion the Contractor shall transmit project record drawings, specifications, addenda and shop drawings to the Architect.

3.2 CLOSEOUT PROCEDURES

A. **Operating and Maintenance Instructions:** Arrange for each Installer of equipment and material that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If

Installers are not experienced in procedures, provide instruction by manufacturer's representatives.

1. Include a detailed review of the following items:
   a. Maintenance manuals and record documents.
   b. Inspection procedures.
   c. Spare parts and materials.
   d. Tools.
   e. Lubricants.
   f. Identification systems.
   g. Control sequences.
   h. Personal and product safety.
   i. Cleaning.
   j. Warranties and bonds.
   k. Maintenance agreements and similar continuing commitments.

B. Demonstration: As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shut-down.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.3 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in "Section 01 7123 – Field Engineering."

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions and requirements in individual Specifications Sections. Complete the following cleaning operations before requesting inspection for Substantial Completion.

1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, and other excess and foreign materials from exposed-to-view interior and exterior surfaces, new and existing.
2. Remove labels that are not permanent labels.
3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace scratched, cracked, chipped and broken glass and other damaged and defective transparent materials.
4. Clean exposed exterior and interior finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
5. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
6. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
7. Clean and rejuvenate permanent facilities and equipment used during the construction period, including but not limited to:
   a. Replace air filters and clean inside of ductwork and housings.

b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
c. Replace lamps that are burned out or noticeably dimmed by use.
d. Remove used lubricants and replace with new, manufacturer-recommended lubricants.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not abandon or bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful and dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

E. Owner's Right to Clean Up: If the Contractor fails to perform final cleaning and removal of protection as specified, and fails to promptly and diligently commence and continue specified cleaning and removal after written notice by the Owner or Architect, the Owner may execute such cleaning and removal and deduct by appropriate Change Order the cost of the cleaning and removal from the Contract Amount. This right of the Owner, if exercised, shall be exercised without prejudice to any other remedy the Owner may have under the Contract Documents or law.

F. Materials for Owner's Use: Where extra materials of value remaining after completion of Work have become the Owner's property, and where extra stock of materials are required by the Contract Documents, arrange for disposition of these materials as directed.

G. Architect's Identification Sign: Return Architect's vinyl identification sign to Architect upon removal of sign supporting structure.

3.4 CONTINUING INSPECTIONS

A. General: As required by special guaranteed warranties, agreements to maintain, workmanship bonds, and similar continuing commitments, comply with Owner's request to participate in inspections at the end of each time period of such continuing commitments. General Contractor and all major subcontractors shall participate in a general inspection of the work approximately one year after the date of Substantial Completion and prior to the one year date to determine the general condition of the Work.

END OF SECTION

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SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: General administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

B. Related Sections:
1. Division 01 “Submittal Procedures” for procedures for submitting warranties.
2. Division 01 “Closeout Procedures” for procedures for contract closeout.
3. Division 01 "Operation and Maintenance Data" for manuals required at closeout.
4. Division 01 "Demonstration and Training."
5. Divisions 02 through 48 Sections for specific warranty requirements for products and installations specified to be warranted.
6. Certifications and other commitments and agreements for continuing services to Owner that are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work nor does it relieve suppliers, manufacturers, and subcontractors required to sign special project warranties.

1.3 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties issued by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged or accessed for construction to warranty Work.

B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement, reinstate the warranty by written endorsement.

The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing defective Work regardless of whether the Owner has benefitted from use of the Work for a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: Owner reserves the right to reject warranties and to limit selection of products with warranties not to conflict with requirements of the Contract Documents.
2. Owner reserves the right to refuse Work where a special warranty, certification or similar commitment is required, until evidence is presented that entities required to sign such commitments are willing to do so.

1.5 SUBMITTALS

A. General: Submit written warranties to the Architect prior to the date of Substantial Completion. If the Substantial Completion date extends past the anticipated date, all warranties shall be updated with the proper Substantial Completion date and resubmitted to the Architect, prior to the actual Substantial Completion.

1. When a designated portion of the Work is completed and occupied or used by the Owner, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. Special Warranties: When the Contract Documents require the Contractor, subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.

1. Refer to individual Sections of Divisions 2 through 48 for specific content requirements and particular requirements for submittal of special warranties.

C. Form of Submittal: At Substantial Completion, submit 3 copies of each required warranty properly executed by the Contractor, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy duty, durable 3-ring vinyl covered loose leaf binders, thickness as necessary to accommodate contents, sized to receive 8-1/2- by 11-inch paper.
2. Provide heavy-duty paper dividers with plastic covered tabs for each separate warranty. Mark tabs to identify the product or installation. Provide a typed description of the product or installation, including the product name and manufacturer, and the name, address and telephone number of the installer.
3. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project name and the name of the General Contractor.

4. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual, as specified in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 01 7830

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance data.

B. Related Sections:
1. Division 01 "Closeout Procedures" for closeout requirements.
2. Division 01 "Closeout Submittals" for warranty closeout for each individual section.
3. Division 01 "Demonstration and Training."
4. Division 07 "Styrene-Butadiene-Styrene Modified Bituminous Roofing" for roofing manuals.
5. Division 02 through 48 Sections for specific operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

C. A/E: Architect / Engineer

1.4 SUBMITTALS

A. Initial Submittal: Submit to the A/E three (3) electronic copies of each manual in final form no later than 60 days prior to commencement of the owner's training. Include a complete operation and maintenance directory.
1. A/E will forward one (1) electronic copy of the manuals received to the Owner for review and comment. The Owner shall receive the final form of the Operation and Maintenance manuals 45 days prior to the commencement of owner training to have adequate time for review and comments.
2. General Contractor will make any corrections required and resubmit all copies until such time the A/E and Owner find them acceptable.

B. Final Submittal: Submit three (3) paper copies of each manual and one (1) electronic copy of each manual in final form evidencing acceptance by the A/E and Owner. The Operation and Maintenance manuals must be delivered to the

Owner (end user) a minimum of 7 days prior to the commencement of any Owner's training on all systems or equipment.

1. Submit all copies to the Owner's Authorized Representative with a transmittal indicating compliance with requirements for submittal of Operation and Maintenance Data. Owner's Authorized Representative will be responsible for distribution to the appropriate parties, including the end user.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, sub-system, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and sub-system and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: For paper copies of manuals enclose title page in transparent plastic sleeve, electronic copies shall have title page as first page of file for manual. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of the Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of A/E.
7. Cross-reference to related systems in other maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include a comprehensive table of contents for all volumes in each binder of the set.

D. Paper Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem and equipment. If possible, assemble instructions for subsystems, equipment and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents and drawing locations.

E. Electronic Manual Contents: Organize into sets of manageable size to ensure files for manual are contained within a single compact disc. Arrange contents alphabetically by file name or bookmarking, for organization to coincide with

system, subsystem and equipment. Ensure instructions for subsystems, equipment and components of one system into a single compact disc.

1. Compact Discs: All files shall be burned on to compact discs and provided in plastic cases. Discs shall be clearly labeled with the same information as required for the manual title page. If more than one manual is present on the disc a listing of the manual contained shall be provided on the label.
   a. If two or more discs are necessary to accommodate data of a system, organize data in each disc into groupings by subsystem and related components. Cross-reference other discs by bookmarking or annotations in the electronic files contained on the disc, if necessary, to provide essential information for proper operation or maintenance of equipment or system.
   b. Discs shall be clearly labeled with the same information as required for the manual title page. If more than one manual is present on the disc, a listing of the manual contained shall be provided on the label.
2. Bookmarking: The O&M manuals shall be fully integrated and navigable. "Fully integrated and navigable", is defined in this context as the ability for users to review and locate information utilizing bookmarks or other file organization methods. Use of folder structures for this purpose will be permitted, provided file nomenclature utilized clearly indicates the type of document the file contains and all information pertinent to a given system, sub-system and/or unit is contained within a single folder.
3. Searching: All files shall be fully searchable using standard text search functions. If scanned copies of documents are provided, these files shall be converted into OCR recognized text format with original image overlay.
4. Acceptable Electronic Formats: Acceptable electronic formats for files provided for manuals shall be as listed below. Contractor shall be responsible to provide free viewers for all formats not listed below for any files provided in their submission.
   a. Word 2002 or newer
   b. Excel 2002 or newer
   c. Adobe Acrobat 8.0 or newer
   d. WAV
   e. WMV
   f. DWF
   g. HTML

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment and component:
1. Fire.
2. Flood.
3. Hurricane.
4. Gas leak.
5. Water leak.
6. Power failure.
7. Water outage.

8. System, sub-system, or equipment failure.
9. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of the Board's operating personnel for notification of Installer, supplier and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, sub-system, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Flow diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation and diagram controls as installed.

E. Piped/Ducted Systems: Diagram piping as installed and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material and finish. Include source information, product information, maintenance procedures, repair materials and sources and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, sub-system, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts and warranty and bond information, as described below.

B. Source Information: List each system, sub-system, and piece of equipment included in the manual identified by product name and arranged to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components. (exploded parts breakdown)
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair and replacement; and reassembly instructions.
5. Aligning, adjusting and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by the Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, sub-system and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, sub-system and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by the Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 "Closeouts Procedures."

END OF SECTION

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

C. Requirement for installer certification that they did not use any non-compliant products.

1.2 RELATED REQUIREMENTS

A. Division 01 - Section - Quality Requirements: Procedures for testing and certifications.

B. Division 01 - Section - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.3 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings.
   2. Interior adhesives and sealants, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings.
   2. Interior adhesives and sealants, including flooring adhesives.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
   1. Concrete.
   2. Clay brick.
   3. Metals that are plated, anodized, or powder-coated.
   4. Glass.
   5. Ceramics.
   6. Solid wood flooring that is unfinished and untreated.

1.4 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; current edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).

C. CAL (CDPHSM) - Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Environmental Chambers; State of California Department of Public Health; v1.1, 2010.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

F. CHPS (HPPD) - High Performance Products Database; Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

G. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.

H. UL (GGG) - GREENGUARD Gold Certified Products; UL Environment; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

I. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition; www.aqmd.gov.

J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

K. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

1.5 SUBMITTALS

A. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

B. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.6 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: State of California Department of Public Health Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Environmental Chambers, using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are:
      a. Current UL GREENGUARD Gold certification.
      b. Current SCS Floorscore certification.
      c. Current SCS Indoor Advantage Gold certification.
      d. Current listing in CHPS High Performance Products Database as a low-emitting product.
      e. Current CRI Green Label Plus certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low-emitting (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde" certification; www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.
      d. Certification by manufacturer that product complies with requirements.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
   2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD Rule 1168.
   2. Joint Sealants: SCAQMD Rule 1168.
   3. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD Rule 1113.
      c. CARB (SCM).

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. All additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Pile caps
   2. Grade beams
   3. Structural slabs

B. This specification section applies to all references in the contract documents to specification section 03 10 00, 03 20 00, or 03 30 00.

C. Related Sections include the following:
   1. Division 31 Section "Earth Moving - Building Pad" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement. None of the following are allowed in any concrete in this project: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: Submit a design mixture for each concrete mixture, proportioned on the basis of field experience or trial mixtures, or both, as required by ACI 318-11, chapter 5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Historical data used as the basis of concrete proportioning: Submit historical data and sample standard deviation calculations, as required by ACI 318-11, chapter 5.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Field quality-control test and inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs qualified personnel on the Project, Flatwork Technicians with at least three (3) years experience, Finishers with at least three (3) years experience and a Supervisor with at least ten (10) years experience in concrete finishing and flatwork.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete for Buildings,"
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   3. ACI 318, “Building Code Requirements for Structural Concrete.”

G. Concrete Testing Service: Owner shall engage (and pay for) a qualified independent testing agency to perform material evaluation tests. Contractor shall engage and pay a qualified independent testing agency to design concrete mixtures.

H. Materials and installed work may require testing and retesting, as directed by Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, including retesting of rejected materials for installed work, shall be done at Contractor’s expense.

I. For all concrete placement events, all steel reinforcement, other embedded items, and formwork shall be set and finalized a minimum of (3) three hours prior to the time of initial concrete placement to allow time for proper observation/inspection by the design team and the testing agency and time for resolution of any discrepancies.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Forms for Exposed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
      a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Forms for Unexposed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
   1. Form foundation elements as indicated on contract documents (typically placed in general notes of the structural plans).

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips (if required): Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82.

C. Deformed-Steel Wire: ASTM A 496.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars (if required): ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II unless otherwise acceptable to Architect.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260 - Do not use in slabs scheduled to receive dry shake floor hardener.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. The vapor retarder shall maintain a permeance of less than .01 perms as tested before and after mandatory conditioning tests (per ASTM E 1745 Section 7.1 and sub-paragraphs 7.1.2-5).
   1. Available Products:
      a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
      b. Fortifiber Building Systems Group; Moistop Ultra.
      c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
      d. Insulation Solutions, Inc.; Viper VaporCheck.
      e. Meadows, W. R., Inc.; Perminator.
      f. Raven Industries Inc.; Vapor Block.
      g. Reef Industries, Inc.; Griffolyn.
      h. Stego Industries, LLC; Stego Wrap.
      i. Viper VaporCheck
      j. Tex-Trude, LP; Xtreme Vapor Barrier.
      k. IntePlus XF Film; Barrier-Bac.
   2. Refer to contract plan documents for minimum vapor retarder thickness in mils.
   3. Vapor proofing mastic: water vapor transmission rate per ASTM E 96 of 0.3 perms or lower.
   4. Seam tape: must have a water vapor transmission rate of 0.3 perms or lower in accordance with ASTM E 96

2.7 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Curing compounds must be approved for use with types of floor finishes and sealers/hardeners specified in Contract Documents. Curing compound shall not interfere with bonding of floor covering. The following list of compounds does not indicate acceptance with the floor finishes utilized. Contractor shall only submit for approval curing compounds that are guaranteed not to interfere with bonding of any floor covering. Contractor assumes all responsibility for compliance of curing compounds with respect to this requirement.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Available Products:

a. Ashford Formula
b. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
c. Burke by Edoco; Aqua Resin Cure.
d. ChemMasters; Safe-Cure Clear.
e. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
f. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
g. Euclid Chemical Company (The); Kurez DR VOX.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; Aqua Kure-Clear.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100 Clear.
l. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
m. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
n. Tamms Industries, Inc.; Horncure WB 30.
o. Unitex; Hydro Cure 309.
p. US Mix Products Company; US Spec Maxcure Resin Clear.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Available Products:
a. Ashford Formula
b. Anti-Hydro International, Inc.; AH Clear Cure WB.
c. Burke by Edoco; Spartan Cote WB II.
d. ChemMasters; Safe-Cure & Seal 20.
e. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
g. Euclid Chemical Company (The); Aqua Cure VOX.
h. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
i. Lambert Corporation; Glazecote Sealer-20.
j. L&M Construction Chemicals, Inc.; Dress & Seal WB.
k. Meadows, W. R., Inc.; Vocomp-20.
l. Metalcrete Industries; Metcure.
m. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
o. Tamms Industries, Inc.; Clearseal WB 150.
p. Unitex; Hydro Seal.
q. US Mix Products Company; US Spec Hydrasheen 15 percent
r. Vexcon Chemicals, Inc.; Starseal 309.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips (if required): ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent (if required): ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive (if required): ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Provide material "type", "grade" and "class" to suit project requirements.

D. Reglets (if required): Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots (if required): Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

A. Repair Underlayment (if required): Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment (if required): Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 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, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.1 percent by weight of cement.

C. The design mixtures for all exterior concrete shall provide a minimum of 4.5 percent entrained air.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
   5. If more than one admixture is used in a concrete mix, assure that only compatible admixtures are used.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Design mixes to provide concrete with the properties as indicated on the structural drawings.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. The time concrete is unloaded shall be recorded on each batch ticket.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise indicated.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install and secure anchor rods prior to placing of concrete.
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   4. Install dovetail anchor slots in concrete structures as indicated.
   5. Provide additional rebar if required to secure rebar dowels in proper location.

B. Do not run any mechanical/electrical/plumbing pipes or conduit horizontally through concrete slabs, unless approved by the Engineer. These items shall also not bear

continuously along grade beams and shall only cross perpendicular over top of grade beam in the concrete thickness below the slab at isolated locations.

C. Do not run any mechanical/electrical/plumbing pipes or conduit through concrete footings and/or pile caps, unless approved by the Engineer. All mechanical/electrical/plumbing items shall be routed to avoid conflicts with concrete construction.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended tape.
   2. Repair damaged areas by cutting patches of required vapor retarder, overlapping damaged area 6 inches and taping all four sides with approved tape.
   3. Seal all penetrations (including pipes) per manufacturer’s instructions.
   4. The vapor retarder shall be sealed at the perimeter.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Maximum spacing of bar supports for slab/mat reinforcement shall be 48 inches on center or less as required to secure reinforcement during construction operations.

E. Precast concrete blocks shall only be used to support reinforcement from the ground. Concrete blocks shall not be used for support of top reinforcement in concrete slabs or mats.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Install bar reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap ends of bars as indicated on the structural contract drawings.

H. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces as specified on drawings or a minimum of two full mesh if not otherwise specified. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Do not continue reinforcement through sides of strip placements of floors and slabs (unless noted otherwise on drawings).
   2. Form joints as indicated on drawings. Do not use metal keyways
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces, where indicated on drawings.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces, where indicated on drawings.
   8. Construction joints shall not be placed in any slab areas with floor coverings prone to cracking, unless written approval is provided the Architect. When construction joints are allowed in slab areas with floor coverings prone to cracking, the contractor shall assure that joints are properly considered in floor covering installation as required to prevent reflective cracking.

C. Doweled Joints (as indicated on drawings): Install dowel bars and support assemblies at joints where indicated.

3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
   1. Place at locations indicated on plans.
   2. Place at concrete construction joints below site grade in order to avoid water intrusion into interior space.
      a. Place at wall to slab (or mat foundation) joints below site grade.
      b. Place at wall to wall joints below site grade.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
   1. All embedded items, including anchor bolts, rebar dowels, etc., shall be set prior to placement of concrete.
   2. For foundation elements, verify that water is not present in the excavation prior to placement of concrete.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not place concrete when temperature is 36 deg F or below or if temperature is expected to reach 36 deg F (or below) within 12 hours of the anticipated time for completing a concrete pour.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: (For formed concrete surfaces not exposed to view) As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: (For formed concrete surfaces exposed to view) As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces to receive a rubbed finish.

C. Rubbed Finish: Unless noted otherwise, all exposed concrete surfaces shall receive a rubbed finish. Consult with Project Architect to determine the type of rubbed finish

prior to pouring of concrete. Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General:
   1. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
   2. See architectural drawings for slab finish requirements or consultant the Project Architect if finishes have not been supplied on the architectural drawings.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
   1. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated, to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and

appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, 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.
   a. Finish surfaces to the following tolerances, see structural drawings

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
2. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread dampened slip-resistive aggregate over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:
   1. Steel reinforcement placement.
   2. Verification of use of required design mixture.
   3. Mixing and delivery time for concrete.
      a. Record the time batched, time arrived, and the time unloaded for each batch of concrete.
   4. Concrete placement, including conveying and depositing.
   5. Curing procedures and maintenance of curing temperature.
   6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of discharge for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change or is questionable.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M.
   a. Test one specimen at 7 days, two specimens at 28 days, and hold one specimen for testing at 56 days, if necessary.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. 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.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, concrete unit weight, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. 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.
11. Additional Tests: 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. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness, per requirements on drawings, according to ASTM E 1155 within 72 hours of finishing.

END OF SECTION

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SECTION 03 0505
UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.3 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.4 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Test Data: Submit report of tests showing compliance with specified requirements.

D. Samples: Submit samples of underslab vapor barrier to be used.

E. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Underslab Vapor Barrier:
   1. Water Vapor Permeance: Not more than 0.010 perms (0.6 ng/(s m2 Pa)), maximum.
   2. Complying with ASTM E1745 Class A.
   3. Thickness: 15 mils (0.4 mm).
   4. Basis of Design:
      a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com.
      b. W. R. Meadows; Perminator Underslab Vapor Barrier (15-mil).
      c. Insulation Solutions, Inc.; Viper Vaporcheck II (15-mil).
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches (150 mm).

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Grout.

B. Related Requirements:
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
   2. Division 09 painting Sections for surface preparation and priming requirements.
   3. Division 13 Section "Metal Building Systems" for structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

C. The general contractor is responsible for coordinating the structural steel shop drawing submittal with all other submittals for elements which attach to structural steel or have an effect on structural steel design or detailing. Hold shop drawing production, ordering of material, fabrication, and other work associated with such elements as required until these other submittals are reviewed and approved. Provide separate submittals for these elements as required. The general contractor shall coordinate between steel supplier and these other suppliers as required.

1.5 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include erection plans, sections, elevations, and details.
   2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   3. Indicate size, material specification, surface preparation and coating for all members and components.
   4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds when backing bars are to remain.
   5. All required field welding shall be indicated on the erection drawings using erection details.
   6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
   7. All column piece drawings shall indicate the grid location of the column.
   8. Reproductions made from contract drawings will not be accepted.
   9. For structural-steel connections indicated to comply with design loads, include structural analysis data by the qualified professional engineer responsible for their preparation.
   10. Allow 14 days for review of structural steel shop drawings, excluding delivery time to and from the contractor.
   11. On projects where submittals are processed electronically, provide Engineer with a minimum of one half-sized copy of shop drawings for office use only.
   12. For shop drawings that are marked "Mark Corrections Noted", provide Architect/Engineer with an electronic record set of the shop drawings and three-dimensional model for informational purposes once all revisions are made.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code – Steel," for each welded joint qualified by testing, including the following:
   1. Power Source.

1.7 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Qualification Data: For Installer and fabricator.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with top coats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.

2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Source quality-control test reports.

G. Survey of existing conditions.

H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repacking and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturer's written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50.

B. Channels, Angles-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Corrosion-Resisting Structural Steel: ASTM A 588/A 588M, Grade 50.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

F. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: ASTM A 847, structural tubing.

G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
   1. Weight Class: Standard, unless otherwise noted on drawings.
   2. Finish: Black, except where indicated to be galvanized.

H. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirements S11.

I. Steel Forgings: ASTM A 668/A 668M.

J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563, Grade C heavy hex carbon-steel nuts; and ASTM F 436, Type 1 hardened carbon-steel washers; all with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852 (also referred to as ASTM A 325 Tension-Control), Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563, Grade C (or Grade DH if indicated to be galvanized) heavy hex carbon-steel nuts; and ASTM F 436, Type 1 hardened carbon-steel washers.
   1. Finish: Plain, except where indicated to be galvanized.

C. Threaded and Nutted Anchor Rods (or Anchor Bolts): ASTM F 1554, Grade 55, weldable, straight.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Plate Washers: ASTM A 36 carbon steel.
   3. Washers: ASTM F 436 hardened carbon steel.
   4. Finish: Plain, except where indicated to be galvanized.

D. Threaded Rods: ASTM A 36
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Washers: ASTM A 36 carbon steel.
   3. Finish: Plain, except where indicated to be galvanized.

E. Clevises: ASTM A 668, Class A.
   1. Clevis Pins: ASTM A108, Grade 1117.
   2. Dimensioning of clevises shall be in accordance with Table 15-4 of the AISC Steel Construction Manual, unless noted otherwise.

F. Turnbuckles: ASTM F 1145, Type 1, Grade 1, Class B.
   1. Dimensioning of turnbuckles shall be in accordance with Table 15-6 of the AISC Steel Construction Manual, unless noted otherwise.

G. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

H. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Primer: SSPC-Paint 25, zinc oxide, alkyd, linseed oil primer.

C. Primer chosen shall be compatible with any additional coatings required.

D. For exposed structural steel, refer to Division 09 sections

E. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 or ASTM A 780.
   1. Dry film shall have at least 94% metallic zinc by weight
   2. Coordinate with Division 09 Sections of field painting if exposed.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. All grout shall have a minimum compressive strength of 5,000 psi at 28 days.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303 “Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
   2. Mark and match-mark materials for field assembly.
   3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces. Do nut thermally cut bolt holts in the field or enlarge holes by burning.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes in the field or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

G. All clevises and turnbuckles shall be manufactured to meet the dimensions and load ratings shown in the AISC Steel Construction Manual.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Pretensioned.
   2. Use standard bolt holes. Slotted holes are not permitted unless indicated.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth for architecturally exposed structural steel members
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC 303 for mill material.
   3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
      a. Grind butt welds flush.
      b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches. This does not apply to columns.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials. This does not apply to intumescent coatings.
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a

dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

E. All structural steel shall be prepared in manner compatible with architectural requirements such as intumescent coatings, applied fire-proofing, high performance coatings, etc. Coordinate to verify compatibility between products chosen and/or methods of preparation. Identify any conflicts to Architect prior to fabrication of structural steel.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish (if required on plans): Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize steel lintels and shelf angles attached to structural frame and located in exterior walls.
3. Galvanize steel exposed to weather.
4. Galvanized anchors and nuts shall be purchased from same supplier and shall be shipped preassembled.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1 and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

5. All grout shall be placed under steel column base plates and achieve 70% of its required 28-day strength prior to placement of concrete for elevated floors which are supported by the steel columns.
6. Grout shall be placed with fluid consistency if column blockouts are used at ground floor slab.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Headed Stud Anchors: Prepare steel surfaces as recommended by manufacturer of headed stud anchors. Use automatic end welding of headed stud anchors according to AWS D1.1 and manufacturer's written instructions. Welding shall develop full capacity of headed stud anchor.

J. Remove all factory piece markings (especially if welded on to the member) by grinding smooth on all elements to be exposed prior to field painting.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Pretensioned
2. Provide and install a tension-control, high-strength bolt-nut-washer assembly for all bolts on field bolted connections.
3. Use standard bolt holes. Slotted holes are not permitted unless indicated.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth for architecturally exposed structural steel connections.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspection.

C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1. See structural drawings for additional requirements on weld inspection.
   1. In addition to visual inspection, test and inspect field welds according to AWS D1.1 and the following inspection procedures, at testing agency's option or as specified on structural drawings:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

F. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

1. All corrections shall be submitted to the Project Architect and Engineer for review and approval. Correction work shall not proceed until approval has been provided.
2. Significant deficiencies in construction which require substantial engineering to resolve may require the contractor to secure the services of a professional engineer at no additional cost to the owner. The Project Architect and/or Engineer of Record will determine if a contractor hired engineer is required depending on the severity of the deficiency and the extent of work involved.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780 and manufacturer's written instructions.

B. Touchup Priming: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Remove all factory piece markings (especially if welded on to the member) by grinding smooth on all elements to be exposed prior to field touchup priming operations. Touchup prime all repaired spots that required field grinding and cleanup which damaged the shop priming.

C. Touchup Painting: Cleaning and touchup painting for exposed steel are specified in Division 09 painting Sections.

3.7 MISCELLANEOUS STEEL

A. Unless otherwise indicated on the structural drawings, provide angles, tubes, plates, channels, and other steel members shown on the architectural and connect with 1/4" fillet weld at all material interfaces. Unless otherwise indicated, the following assumptions shall be made regarding spacing and member size in order to establish an all-inclusive structural steel bid price. Plates-5/16", Cont. Bent Plate- 5/16", Angle-L5x5x3/8, Channel Horizontally Oriented- C12x30, Channel Vertically Oriented-C6x8.2, Wide Flange-W18x35, Tube-HSS 6x6x5/16. Members/pieces shown in section shall be assumed continuous unless otherwise noted. Spacing intervals of stiffeners, hangers, kickers, -30"OC. Columns W12x79." It is the contractor's responsibility to coordinate and verify all structural steel shapes indicated in architectural drawings, prior to bid.

END OF SECTION

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SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior non load-bearing wall framing (Delegated design. See Performance Requirements).

B. This specification section applies to all references in the contract documents to specification section 05 41 00 as well as section 05 40 00.

C. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
   2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads shown in plans and for resisting wind pressures determined from the wind speeds, exposure and risk category provided on plans.
   1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non Load-Bearing Wall Framing: Horizontal deflection of 1/600 of the wall height for walls supporting brick/masonry veneer. Horizontal deflection of 1/360 of wall height for all other walls. Ultimate wind loads may be multiplied by 0.42 as allowed by IBC for purposes of wall deflection limits.
      b. The above deflection limits apply at all spans of the framing member, including cantilever spans and overhangs.
   2. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/4 inch.
   4. Design cold-formed framing systems to withstand any design loads and forces acting onto the cold-formed framing systems from any storefront/glass

assemblies. Proper consideration of point loads from mullions shall be indicated in the design calculations.

5. Design cold-formed framing systems to accommodate connections of any storefront/glass assemblies.
6. All framing conditions which preclude the complete usage of cold-formed metal framing as indicated on the construction documents shall be identified prior to bidding or be resolved after bidding at no additional cost to the owner. Provide fixed connections to the structure where required for stability at cantilever conditions. Connections to structure shall be designed and provided by cold-formed metal framing supplier. Only provide fixed connections to structure when required for stability. Do not add kicker braces to reduce the span length of exterior wall studs.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work. Layout for metal stud wall framing shall include building elevations and/or wall plans indicating applicable wall sections in shop drawings. Provide wall sections for all unique exterior wall framing conditions around perimeter of building, including applicable locations where sections have not been provided in contract drawings. Contact Architect/Engineer prior to submittal of Shop Drawings if any additional information is required. For exterior canopies supported by cold-formed metal framing, the detailing of canopy connections to the cold-formed metal framing shall be clearly indicated on the shop drawings (general contractor shall coordinate loading and connection compatibility between canopy supplier and cold-formed metal stud supplier).
   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Submit shop drawings, sealed and signed by a qualified Louisiana Registered Civil Engineer.
   3. Allow 21 days for review of cold-formed metal framing shop drawings, excluding delivery time to and from the contractor.
   4. For shop drawings that are marked “Mark Corrections Noted”, provide Architect/Engineer with an electronic record set of the shop drawings for informational purposes once all revisions are made.

5. Do not submit shop drawings prior to review and approval of storefront/glass assembly submittals and pre-engineering metal building submittals.

C. Welding certificates (if any welding is required).

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
   2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

I. The general contractor is responsible for coordinating with the cold-formed metal framing designer to ensure the metal framing is installed in accordance with the approved shop drawings. The Architect/Engineer is not responsible for verifying proper installation of cold-formed metal framing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing, not including pre-engineered roof trusses, by one of the following:
   1. Allied Studco.
   2. AllSteel & Gypsum Products, Inc.
   3. California Expanded Metal Products Company.
   4. Clark/Western Steel Framing.
   5. Consolidated Fabricators Corp.; Building Products Division.
   6. Craco Metals Manufacturing, LLC.
   7. Custom Stud, Inc.
   8. Dale/Incor.
   9. Design Shapes in Steel.
   10. Dietrich Metal Framing; a Worthington Industries Company.
   11. Formetal Co. Inc. (The).
   12. Marino\Ware; a division of Ware Industries.
   13. Quail Run Building Materials, Inc.
   14. SCAFCO Corporation.
   15. Southeastern Stud & Components, Inc.
   16. Steel Construction Systems.
   17. Steeler, Inc.
   18. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60, A60, AZ50, or GF30.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90.

C. Screws: All screws used in the manufacture of steel roof trusses shall be exterior rated zinc coated self-drilling screws.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0329 inch.
   2. Minimum Flange Width: 1-5/8 inches.
   3. Section Properties: As required by design. See drawings for required depth of wall.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0329.
   2. Minimum Flange Width: 1-1/4 inches.
   3. Section Properties: As required by design. See drawings for required depth of wall.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0428 inch.
   2. Flange Width: 1 inch plus the design gap for 1-story structures.
   3. Section Properties: As required by design. See drawings for required depth of wall.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0428 inch.
      b. Minimum Flange Width: 1 inch plus twice the design gap.
      c. Section Properties: As required by design. See drawings for required depth of wall.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: As required by design but in no case less than 0.0428 inch.
      b. Minimum Flange Width: width equal to the sum of outer deflection track flange width plus 1 inch.
      c. Section Properties: As required by design. See drawings for required depth of wall.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers, knee braces, and girts.
   9. Joist hangers and end closures.
   10. Hole reinforcing plates.
   11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout (if required): Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout (if required): Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims (if required): Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets (if required): Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
   1. Maximum Stud Spacing: 16 inches, or as indicated.

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

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. At Contractor’s option, single or double deflection tracks may be used.
   2. Install single deflection track and attach to building structure.
   3. Install double deep-leg deflection tracks and anchor outer track to building structure.
   4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system. Provide miscellaneous framing and connections as required for support of all masonry veneer, cast stone bands, and other wall covering elements.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Shop fabricated steel items.

1.3 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

D. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.

E. Section 05 5100 - Metal Stairs.

F. Section 05 5213 - Pipe and Tube Railings.

G. Section 09 9000 - Painting and Coating: Paint finish.

1.4 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

H. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2013.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

J. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.

K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010 w/Errata.

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

O. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

Q. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit specification and installation recommendations for manufactured products furnished under this Section, including paint products and grout. List items by manufacturer name and brand name or catalog number.

C. Design Calculations: For items specified to meet performance criteria, provide structural data to demonstrate compliance with requirements. Data shall be sealed and signed by a professional structural engineer licensed by the State of Louisiana to provide this type of engineering.

D. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

E. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.

C. Plates: ASTM A283.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black and hot-dip galvanized finish, as indicated.

E. Fasteners: Type 304 stainless steel for exterior use and at exterior walls. Select fasteners for type, grade and class required..

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 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.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.
   1. Concrete Materials and Properties: Comply with requirements in Section 03 3000 - "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.

C. Lintels: As detailed; galvanized finish.

D. Door Frames for Overhead Door Openings: Channel sections; prime paint finish.

E. Recessed Mat Frames: As detailed; steel, galvanized finish.

F. Foot Scrapers, Mud and Foot Grilles, and Pans: As detailed; aluminum, mill finish.

2.4 FINISHES - STEEL

A. Comply with NAAMM - "National Association of Architectural Metal Manufacturers" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

B. Prime paint all steel items.

1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

C. Prepare surfaces to be primed in accordance with SSPC-SP2.

D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

E. Prime Painting: One coat.

F. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft (530 g/sq m) galvanized coating.

G. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.5 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.5 CLEANING

A. Clean exposed surfaces as recommended by the manufacturer.

3.6 PROTECTION

A. Upon completion of installation, contractor to protect the finished work from damage by work of other sections during the remainder of construction.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.

B. Preservative treated wood materials.

C. Communications and electrical room mounting boards.

D. Concealed wood blocking, nailers, and supports.

1.3 RELATED REQUIREMENTS

A. Division 01 - Section - Volatile Organic Compound (VOC) Content Restrictions.

B. Division 03 - Section - Cast-in-Place Concrete: Setting anchors in concrete.

C. Division 07 - Section - Weather Barriers: Air barrier over sheathing.

D. Division 07 - Section - Sheet Metal Flashing and Trim: Sill flashings.

E. Division 09 - Section - Gypsum Board Assemblies: Gypsum-based sheathing.

1.4 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.

C. PS 1 - Structural Plywood; 2009.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

E. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2014.

1.5 SUBMITTALS

A. See Division 01 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
   1. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
   2. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Southern Pine, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, exterior grade.
   2. Plywood Exposed to View but Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.4 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.5 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. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. 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.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.2 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.

3.3 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size and Location: As indicated on drawings.

3.5 SITE APPLIED WOOD TREATMENT

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

C. Allow preservative to dry prior to erecting members.

3.6 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419.
   1. Comply with applicable regulations.

2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Cabinet hardware.

C. Preparation for installing utilities.

1.3 RELATED REQUIREMENTS

A. Division 06 - Section - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Division - Section - Countertops.

1.4 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2009 (ANSI/HPVA HP-1).

E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

F. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; National Hardwood Lumber Association; 2011.

G. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2010.

1.5 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.7 SUBMITTALS

A. See Division 01 - Section - Submittal Procedures.

B. **General: The submittal package shall be submitted as a complete package, including the following listed below. Individual submittals will be returned as incomplete until the complete package is submitted.**

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Indicate the location, alignment and orientation of all "grained", directional laminate veneers on all exposed and semi-exposed surfaces.
   2. Show location and sizes of blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cut-outs and holes for plumbing fixtures, faucets, soap dispensers, grommets and other items installed in architectural woodwork.
   4. Minimum Scale of Plan Drawings: 1/4 inch to 1 foot (1:48)
   5. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot (1:8).
   6. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards (AWS).
   7. Include certification program label.

D. Product Data: Provide data for hardware accessories.

E. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories and finishing materials and processes.

F. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

G. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

H. Samples:
   1. Plastic-laminates, 8 by 10 inches (200 by 250 mm) for each type, color, pattern, and surface finish with 1 sample applied to core material.
   2. Solid-surfacing materials, 5 inches square.

3. Corner pieces as follows:
   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
   b. Miter joints for standing trim.
4. Exposed cabinet hardware, one unit of each type and finish.

I. Product Certificates: For each type of product, signed by product manufacturer.

J. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

K. Qualification Data: For Installer and fabricator.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Quality Certification: Provide AWI Quality Certification Program (QCP) inspection report and quality certification of completed work.
   1. Provide labels or certificates indicating that the work complies with requirements of AWS Grade or Grades specified.
   2. Prior to delivery to the site provide shop drawings with certification labels.
   3. Provide labels on each product when required by certification program.
   4. Upon completion of installation provide certificate certifying that the installation and products meet the specified requirements.
   5. Arrange and pay for inspections required for certification.
   6. Replace, repair, or rework all work for which certification is refused.

E. Installer Qualifications: Certified participant in AWI's Quality Certification Program. Employs skilled installers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.9 MOCK-UP

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Wall and base cabinet with plastic laminate/solid surface countertops for each type of material and finish.
3. Upon acceptance, mock-ups will demonstrate the minimum standard for the Work.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Locate where directed by Architect.

C. Coordination: Coordinate sizes and locations of framing, blocking, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

B. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.11 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature at occupancy levels during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.12 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.1 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards (AWS) for Premium Grade.

B. All wood panel products shall be "No Added Urea Formaldehyde" (NAUF); no exceptions.

C. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Decorative laminate.
   2. Finish - Exposed Interior Surfaces: Decorative laminate.
   3. Finish - Concealed Surfaces: Manufacturer's option.
   4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
      a. Thickness: 3 mm.
   5. Door and Drawer Front Retention Profiles: Fixed panel.
   6. Casework Construction Type: Type A - Frameless.
   7. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
   8. Adjustable Shelf Loading: 50 lbs. per sq. ft..
      a. Deflection: L/144.
   9. Cabinet Style: Flush overlay.
      a. Reveal Dimension: As indicated on Drawings.
   10. Cabinet Doors and Drawer Fronts: Flush style.
   11. Drawer Side Construction: Multiple-dovetailed.
   12. Drawer Construction Technique: Dovetail joints.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. All substrate material is to be to AWI Standard for **Premium** grade, laminate cabinets. **Particle Board** is not to be used on this project, without exception. Substrate materials to be as follows:
   1. Interior Type, hardwood veneer core, Grade B-B plywood.
   2. Medium Density Overlay, DOC PS 1.
      a. Plywood - Any softwood species complying with PS-1/ANSI A 199.1 standards; APA Interior Type, veneer core, B-B grade; 3/4-inch thick unless otherwise indicated.
   3. Solid hardwood lumber.
      a. Hardboard: AHA A135.4.

2.3 LAMINATE MATERIALS

A. Manufacturers:
   1. Panolam Industries International, Inc\Nevamar : www.nevamar.com.
   2. Wilsonart International, Inc; BASIS OF DESIGN: www.wilsonart.com.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

C. Provide specific types as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
   2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, colors as scheduled, finish as scheduled.
   3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, color as selected by Architect, finish as scheduled.
   4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.
   5. Colors and Patterns:
      a. **BASIS OF DESIGN MANUFACTURER AND COLORS/FINISH**- Use as a group. No substitutions.
         1) Plastic Laminate (PL1):
            (a) Manufacturer: Wilsonart
               (1) Color: 1500-60 Grey
               (2) Finish: Matte
         2) Plastic Laminate (PL 2):
            (a) Manufacturer: Wisonart
               (1) Color: 4623-60 Graphite Nebula
               (2) Finish: Matte
      b. Alternate to Basis of Design Manufacturer and color/finish- Use as a group. No substitutions.
         1) Plastic Laminate (PL 1) Alternate:
            (a) Manufacturer: Nevamar
               (1) Color: S6003T Dove Gray
               (2) Finish: Textured
         2) Plastic Laminate (PL 2) Alternate:
            (a) Manufacturer: Nevamar
               (1) Color: MR6002T Charcoal Matrix
               (2) Finish: Textured

2.4 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
   1. General: Do not use adhesives that contain urea formaldehyde.
   2. Adhesive for Bonding Plastic Laminate: Un-pigmented contact cement.
   3. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic grommets for cut-outs, in color as selected by Architect.
   1. Size: 3 inch (76 mm), round.

G. Low Profile Counter Support Brackets:
   1. Manufacturer:
      a. Hafele; Work Surface Bracket, Model No. HA-287.74.307.
         1) Size: 21 inches by 28 inches by 1-3/4 inches.
         2) Finish: Epoxy Coated Steel. Color to be selected by Architect.
      b. Rakks: Counter Support Bracket, Model No. EH-1824.
         1) Size: 18 inches by 24 inches by 2 inches.
         2) Finish: 6063 T-6 Extruded Aluminum.
   2. Load Capacity 450 pounds, minimum.

2.5 HARDWARE

A. Hardware: BHMA A156.9, types as indicated for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

E. Catches: Magnetic.

F. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.

G. Hinges: European style concealed self-closing type, BHMA No. A156.9, B01602, steel with polished finish.

2.6 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL approved identification on fire retardant treated material.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.7 FABRICATION

A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated, as required, for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

B. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. For woodwork fabrication taking place within a 60-mile radius of the site, notify the Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

F. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

G. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.

H. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.
1. Shop-cut openings to maximum extent practical to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of openings in wood substrate countertops with a coat of varnish.

2.8 SHOP FINISHING

A. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards (AWS), Section 5 - Finishing for Grade specified and as follows:

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require back-priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before installation, acclimate woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

C. Verify adequacy of backing and support framing.

D. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

G. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
   1. Use treated wood blocking and nailers when attaching directly to concrete floor slab.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Maintain veneer sequence matching of cabinets with transparent finish.
   3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with toggle bolts through metal backing or metal framing behind wall finish.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   3. Secure backsplashes [to tops with concealed metal brackets at 16 inches (400 mm) o.c.] [and] [to walls with adhesive].
   4. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING

A. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Board insulation at cavity wall construction, over roof deck, and Metal Composite Material Wall Panel System.

B. Batt insulation and vapor retarder in exterior wall and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.3 RELATED REQUIREMENTS

A. Division 01 - Section - Volatile Organic Compound (VOC) Content Restrictions.

B. Division 01 - Section - Cold-Formed Metal Framing: Board insulation as wall sheathing.

C. Division 07 - Section - Weather Barriers: Separate air barrier and vapor retarder materials.

D. Division 07 - Section - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

E. Division 09 - Section - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.4 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2014.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2013.

G. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.5 SUBMITTALS

A. See Division 01 - Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation Inside Masonry Cavity Walls: Extruded polystyrene board.

B. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene board.

C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

D. Insulation Over Roof Deck: Polyisocyanurate board.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: ASTM C578, Type X; extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

3. Complies with fire-resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
4. Board Size: 48 x 96 inch (1220 x 2440 mm).
5. Board Thickness: 2 inches (50 mm).
6. Board Edges: Square.
7. Thermal Resistance: R-value of 5.0 per 1 inch (25.4 mm) at 75 degrees F (24 degrees C) mean temperature.
8. Compressive Resistance: 15 psi (104 kPa).
9. Board Density: 1.30 lb/cu ft (21 kg/cu m).
10. Water Absorption: 0.3 percent by volume, maximum.
11. Manufacturers:
    a. Dow Chemical Co: www.dow.com.
    b. Owens Corning Corp: www.owenscorning.com.
12. Substitutions: See Section 01 6000 - Product Requirements.

B. Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 2.
1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Compressive Strength: 20 psi (138 kPa)
4. Board Size: 48 x 96 inch (1220 x 2440 mm).
5. Board Thickness: 3 inches (76.2 mm).
6. Board Edges: Square.
7. Manufacturers:
    a. Carlisle Coatings & Waterproofing, Inc; HP-H: www.carlisle-ccw.com.
    b. Johns Manville; ENRGY 3: www.jm.com.
    c. Certain Teed; FlintBoard ISO: www.certainteed.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.3 BATT INSULATION MATERIALS

A. Mineral Fiber Batt Insulation: Semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Sound Control locations as indicated on the drawings:
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Thermal Resistance: R of 15.
4. Thickness: 3.5 inch (89 mm).
5. Manufacturers:
    a. Johns Manville International, Inc.; TempControl Batts: www.jm.com.
    b. Thermafiber, Inc, UltraBatt www.thermafiber.com.
    c. ROXUL, Inc; ComfortBatt: www.rspec.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.4 ACCESSORIES

A. Tape: Manufacturer recommended self-adhering type, mesh reinforced, 2 inch (50 mm) wide.

B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

D. Protection Board for Above Roof Insulation.
   1. High-Density polyiso cover board:
      a. Thickness: 1/2 inch (13 mm).
      b. Width: 48 inch (1219 mm).
      c. Length: 96 inch (2438 mm).
      d. Compressive Strength (ASTM D1621): 110 psi (758 kPa).
      e. Water Absorption (ASTM C209): <1% by volume.
      f. Resistance to Mold (ASTM D3272): Pass.
      g. Thermal Resistance (R-Value): 2.5.
      h. Acceptable Products:
         1) GAF; EnergyGuard HD Plus: www.gaf.com.
         2) Firestone Building Products; Isogard HD Cover Board: www.firestonebpco.com.
         3) Substitution: See Section 01 6000 - Product Requirements.

E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

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

3.2 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches (406 mm) on center with manufacturer recommended mechanical fasteners. Tape all joints with manufacturer's minimum 4 inch (102 mm) wide sealant tape; comply with ASTM E2357.

B. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Place 6 inch (150 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.3 BOARD INSTALLATION AT CAVITY WALLS

A. Adhere a 6 inch (150 mm) wide strip of polyethylene sheet over expansion joints with double beads of manufacturer recommended adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Install boards to fit snugly between wall ties.
   1. Place membrane surface facing out, and tape seal board joints.

C. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

E. Place 6 inch (150 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.4 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Board Installation Over Roof Deck, General:
   1. See applicable roofing specification section for specific board installation requirements.
   2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions.
   3. Do not apply more insulation than can be covered with roofing in same day.

3.5 BATT INSTALLATION

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

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Coordinate work of this section with construction of air barrier seal specified in Section 07 2500.

3.6 PROTECTION

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

END OF SECTION

SECTION 07 2500
WEATHER BARRIERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls and joints around frames of openings in exterior walls.

1.3 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 05 4000 - Cold-Formed Metal Framing: Water-resistive barrier under exterior cladding.

C. Section 06 1000 - Rough Carpentry: Water-resistive barrier under exterior cladding.

D. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

E. Section 09 2116 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

1.4 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.5 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2013.

E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.6 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Membrane Air Permeance: Not to exceed 0.0004 cfm/sq. ft. of surface area (at specified thickness) at 1.57 lbf/sq. ft. pressure difference (0.002 L/s x sq. m of surface area at 75 Pa) when applied to CMU wall; when tested per ASTM E 2178.

C. Membrane Vapor Permeance: Not more than 12 perms; when tested per ASTM E 96, Method B.

D. UV Exposure Limit: Not more than 180 calendar days: per ASTM D 412 and ASTM E 96 Method B.

1.7 AIR BARRIERS

A. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The air barrier shall have the following characteristics:
   1. It must be continuous, with all joints made airtight.
   2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water. (1.57 psf.)(equal to 0.02L/sq. m @ 75 Pa.).
   3. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
   4. It shall be durable or maintainable.
   5. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
      a. Foundation and walls.

b. Walls and windows or doors.
c. Different wall systems.
d. Wall and roof.
e. Wall and roof over unconditioned space.
f. Walls, floor and roof across construction, control and expansion joints.
g. Walls, floors and roof to utility, pipe and duct penetrations.

6. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.8 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.
   1. Provide data complying with thickness requirements.

C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counter-flashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.
   2. Include details of mockups.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
   1. Provide data complying with thickness requirements.

E. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.
   1. Provide independent agency testing reports for ASTM E 2357.

1.9 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Pre-installation Conference: Conduct conference at Project site.
   1. Include installers of other construction connecting to air barrier, including waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.
   2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

C. Source Limitations: Obtain primary air barrier material and wall flashing through one source from a single manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
   1. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Store rolls according to manufacturer's written instructions.

1.11 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.
   1. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.12 WARRANTY

A. Manufacturer’s Warranty: Manufacturer's standard form in which manufacturer will replace or repair fluid applied membrane systems that do not comply with requirements within specified warranty period.
   1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of sheathing of exterior walls use air barrier coating.

2.2 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.

B. Air Barrier Coating:
   1. Material: Silica-fortified rubber.
   2. Adhesion to Paper and Glass Mat Faced Sheathing: Sufficient to ensure failure due to delamination of sheathing.
   3. Dry Film Thickness: 35 mils (0.035 inch) (0.89 mm), minimum.
   4. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
   5. Water Vapor Permeance: 10 perms (574 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.
   6. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 3 months weather exposure.
   7. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.

8. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
9. Nail Sealability: Pass, when tested in accordance with ASTM D1970.
10. VOC Content: 100 g per L or less.
11. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
12. Products:
    a. Grace Construction Products; Perm-A-Barrier VP: www.graceconstruction.com.
    b. Henry Company; Air-Bloc 33MR: www.henry.com.
    c. Tremco, Inc.: ExoAir 230; www.tremcosealants.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.3 SEALANTS

A. Primers, Cleaners, and Other Sealant Materials: As recommended by weather barrier manufacturer, appropriate to application, and compatible with adjacent materials.

2.4 ACCESSORIES

A. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Butyl rubber sheets laminated to both sides of an elasticized polyethylene sheet.
   2. Thickness: 40 mil (0.040 inch) (1.02 mm), nominal.
   3. Products:
      a. As recommended by weather barrier manufacturer, appropriate to application, and compatible with adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 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 primer and membrane in accordance with manufacturer's instructions.

3.3 INSTALLATION

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

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Coatings:

1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
3. Use flashing to seal to adjacent construction and to bridge joints.

D. Openings and Penetrations in Exterior Weather Barriers:
1. Coordinate all penetration flashing requirements with weather membrane manufacturer prior to installation.
2. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
3. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
4. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
5. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
6. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
7. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.4 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.

B. Take digital photographs of each portion of the installation prior to covering up.

3.5 PROTECTION

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

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.

C. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.4 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2012.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.

C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2010.

E. ASTM E2837 - Standard Test Method for Determining Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2011.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2009.

G. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

H. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.

I. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

K. UL 1479: Fire Test of Through-Penetration Firestops.

L. UL 723: Surface Burning Characteristics of Building Materials.

M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Underwriters Laboratories Inc.; 2004.

N. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer Qualification: Submit qualification statements for installing mechanics.

1.6 DEFINITIONS

A. Definitions: As used in this Section, the following definitions apply:
   1. Firestop systems: Complete, tested assemblies including wall/floor construction, penetrating items, and field-applied materials designed to prevent the spread of fire through openings.
   2. Firestop devices: Factory-built products designed to resist the spread of fire through floor and wall openings, and require only assembly and installation at the project site.
   3. Firestopping: Field-applied component materials of firestop systems, which form the seal against spreading fire.
   4. Smoke seal systems: Systems designed to stop the spread of smoke through smoke walls. To be a smoke seal system, the system must have at least a one-hour fire-rating.

1.7 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestop systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Systems: Provide firestop systems with F ratings indicated, as determined per ASTM E 814 and UL 1479, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814 and UL 1479, where any of the following conditions exist:
   1. Penetrations that incorporate penetrating items that is in contact with combustible materials in acceptable areas.
   2. Penetrations that are located outside of wall cavities and fire-resistive shaft enclosures.
   3. Penetrations that are located in construction containing doors required to have a temperature rise rating.
   4. Penetrations that incorporate penetrating items larger than a 4 inch diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. Special Conditions: For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
   2. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
   3. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.8 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
   4. Provide systems tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly.
   5. Provide firestopping products that bear the classification marking of qualified testing and inspecting agency.

B. Single Source Responsibility: Obtain firestopping for each type of penetration and construction condition from a single manufacturer.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by the manufacturer.
   2. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:.
   3. With minimum 3 years documented experience installing work of this type.
   4. Able to show at least 5 satisfactorily completed projects of comparable size and type.
   5. Licensed by authority having jurisdiction.

E. Selection: Contractor shall select firestop systems, based on information in the Contract Drawings and on conditions that are expected to exist during installation, from the acceptable types specified in this Section, to satisfy all of the following criteria:
   1. Systems shall meet or exceed the required fire-resistance-rating of the construction involved at each penetration.
   2. Systems shall be rated for installation in the type of construction involved at each penetration.
   3. Systems shall be rated for use in conjunction with penetrating items of the type, size, and number involved at each penetration.

F. Asbestos: Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

G. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

H. Pre-Installation Conference: Before start of firestopping work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Require attendance with all parties directly influencing the quality of the work or affected by the performance of the work.
   2. Notify Architect well in advance of meeting.

I. Engineering Judgments: For those firestop applications that exist for which no approved tested system is available through a manufacturer, an engineering judgment derived from similar system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time) and be provided via approved manufacturer.

1.9 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft (1/3 linear m).

B. Obtain approval of authority having jurisdiction before proceeding.

C. If accepted, mock-up will represent minimum standard for the Work.

D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.

B. Storage and Handling: Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.11 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.
   1. Ventilate application areas per firestopping manufacturer's instructions by natural means or, where this is inadequate, forced air circulation.

C. Sequencing and Scheduling: Commence firestopping in each location after penetrating items are complete and tested but prior to concealing the openings.
   1. Firestopping shall precede gypsum board finishing.

D. Agency Inspections: Do not conceal firestopping installations behind other construction until authorities having jurisdiction, if required, have examined each installation.

PART 2 PRODUCTS

2.1 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:

1. 3M Fire Protection Products: www.3m.com/firestop.
2. Hilti, Inc: www.us.hilti.com.
3. Specified Technologies, Inc: www.stifirestop.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Firestopping: Any material meeting requirements.

C. Firestopping Materials with Volatile Content: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

D. Compatibility: Provide components that are compatible with each other, the substrates forming openings, and the penetrating items, if any, under conditions of service and application, as demonstrated by firestopping manufacturer's testing and field experience.

E. Accessories: Provide accessory components for each firestopping system specified by the firestopping manufacturer and approved for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
   1. Permanent forming/damming/backing materials including the following:
      a. Semi-refractory fiber (mineral wool) insulation.
      b. Ceramic fiber.
      c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
      d. Fire-rated form board.
      e. Joint fillers for joint sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Metal collars and sleeves.

F. Mold Resistance: Provide firestoppping materials with mold and mildew resistance rating of 0 as determined by ASTM G21.

G. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

H. Fire Ratings: See Drawings for required systems and ratings.

2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
   2. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
   3. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.

4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: In addition, provide systems that have been tested to show W Rating as indicated.
   4. Listing by UL, FM, or Intertek in their certification directory will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: In addition, provide systems that have been tested to show W Rating as indicated.
   4. Listing by UL, FM, or Intertek in their certification directory will be considered evidence of successful testing.

2.3 MIXING

A. General: For those products requiring mixing prior to application, comply with firestopping manufacturer's directions to produce firestopping products of uniform quality for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examination: Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected, and penetrating items are complete and tested.

B. Verify openings are ready to receive the work of this section.

C. Environmental Conditions: Verify that environmental conditions are safe and suitable for installation of firestop products.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install damming materials to arrest liquid material leakage.

3.3 CONDITIONS REQUIRING FIRESTOPPING

A. General: Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safeing, or otherwise.

B. Through-Penetrations: Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations: Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.

D. Construction Joints/Gaps: Firestopping shall be provided at the following locations:
   1. Between the edges of floor slabs and exterior walls
   2. In the control joint in masonry walls and floors
   3. In expansion joints

E. Smoke-Stopping: Smoke-Stops shall be provided for Through-Penetrations, Membrane-Penetrations, and Construction Gaps with a material approved and tested for such application as required by other Sections as listed in 1.1. B "Related Sections".

3.4 INSTALLATION

A. General: Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
   1. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
   2. Coordinate with plumbing, mechanical, electrical and other trades, to assure that all pipe, conduit, cable, and other items, which penetrate fire-rated construction have been permanently installed prior to installation of firestops. Schedule and sequence the work to assure that partitions and other

construction, which would conceal penetrations are not erected prior to the installation of firestops.

3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
4. Seal holes and penetrations to ensure an effective smoke seal.
5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
6. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.
7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction: When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

C. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

D. Do not cover installed firestopping until inspected by authority having jurisdiction.

E. Install labeling required by code.

3.5 FIELD QUALITY CONTROL

A. Maintain onsite copy of submittal package including system drawings.

B. Prepare and install firestopping systems in accordance with manufacturer’s printed instructions and recommendations.

C. Follow safety procedures recommended in the Material Safety Data Sheets.

D. Finish surfaces of firestopping, which are to remain exposed in the completed work to a uniform and level condition.

E. Accessibility: All areas of work must be accessible until inspection by the applicable Code Authorities.

F. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.6 CLEANING

A. Clean adjacent surfaces of firestopping materials.
   1. Remove excess firestopping materials as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

3.7 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

B. Protect firestopping during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so that firestop systems are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestop systems complying with specified requirements.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Sealants and joint backing.

B. Precompressed foam sealers.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders:

C. Section 07 8400 - Firestopping: Firestopping sealants.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

E. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

F. Section 09 3000 - Tiling: Sealant used as tile grout.

1.4 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2010.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.6 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.7 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
   1. For each joint-sealant product indicated.

C. Samples: Submit two samples, 12 x 12 inch (305 x 305 mm) in size illustrating sealant colors for selection.
   1. For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

F. Qualification Data: Submit qualification data for firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, submit the following reports:
   1. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's recommendations for primers and substrate preparation needed to obtain adhesion.
   2. Product test reports for each type of joint sealer, evidencing compliance with requirements specified.

H. Warranties: Special warranties specified in this Section.

1.8 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

D. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.9 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window, wall, and air barrier system under provisions of Section 01 4000.

B. Construct mock-up with specified sealant types and with other components noted.
   1. To verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   2. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.11 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

B. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.12 WARRANTY

A. See Section 01 7800 - 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 installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

D. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

E. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion

F. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

G. Exclusions: Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 SEALANTS

A. Type JS-1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Applications: Use for:
      a. Joints between concrete and other materials.
      b. Joints between metal frames and other materials.
      c. Other exterior joints for which no other sealant is indicated.
      d. Joints that are up to 1/2 inch (13 mm) wide, maximum.
   3. Polyurethane Products:
      a. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com.
      b. BASF Construction Chemicals-Building Systems; MasterSeal NP 1: www.buildingsystems.basf.com.

c. Tremco Commercial Sealants and Waterproofing; Vulkem 116: www.tremcosealants.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

B. Type JS-2 - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
1. Face color: To be selected from manufacturer's full range by Architect.
2. Size as required to provide weathertight seal when installed.
3. Provide product recommended by manufacturer for traffic-bearing use.
4. Applications: Use for:
a. Exterior wall expansion joints.
b. Joints in excess of 1/2 inch (13 mm) wide.
5. Products:
a. EMSEAL Joint Systems, Ltd; 25V Pre-Formed Expanding Foam Sealant: www.emseal.com.
b. Dayton Superior Corporation; Polytite R Pre-Compressed Joint Sealant: www.daytonsuperior.com.
c. Tremco Global Sealants; Illmod 600 Pre-Compressed Impregnated Foam Seal: www.tremcosealants.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Type JS-3 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
1. Applications: Use for:
a. Concealed sealant bead in sheet metal work.
b. Concealed sealant bead in siding overlaps.
2. Products:
a. As recommended by metal panel manufacturer.

D. Type JS-4 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Applications: Use for:
a. Interior wall and ceiling control joints.
b. Joints between door and window frames and wall surfaces.
c. Other interior joints for which no other type of sealant is indicated.
2. Products:
a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
b. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com.
c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
d. Tremco Global Sealants; Trimflex 834 Siliconized Interior Acrylic Latex Sealant: www.tremcosealants.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

E. Type JS-5 - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Applications: Use for:

a. Joints between plumbing fixtures and floor and wall surfaces.
b. Joints between kitchen and bath countertops and wall surfaces.

2. Products:
   a. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
   b. Tremco Global Sealants; Tremsil 200 General Construction Grade Silicone Sealant - White: www.tremcosealants.com.
   c. Dow Corning Corporation; 786 Sealant M White: www.dowcorning.com.
   d. Momentive Performance Materials Inc./General Electric Company; SCS1700 Sanitary Silicone Sealant: www.ge.com/silicones
   e. Substitutions: See Section 01 6000 - Product Requirements.

F. Type JS-6 - Acoustical Sealant for Concealed Locations:
1. Composition: Acrylic latex emulsion sealant.
2. Applications: Use for concealed locations only and as recommended by manufacturer:
   a. Sealant bead(s) to be located as recommended by manufacturer for best acoustical performance.
3. Products:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.
   b. Tremco Global Sealants; Acoustical Sealant Sound Damping Sealant: www.tremcosealants.com.
   c. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.

G. Type JS-7 - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; multi- component.
1. Color: As selected from manufacturer's full range by Architect.
2. Applications: Use for:
   a. Joints in sidewalks and vehicular paving.
3. Products:
   a. Pecora Corporation; DynaTrol II-SG Self Leveling, Polyurethane Slope Grade, Traffic-Grade Sealant: www.pecora.com.
   b. BASF Construction Chemicals-Building Systems; Sonolastic SL 2 Self-Leveling Polyurethane Sealant: www.buildingsystems.basf.com.
   c. Sika Corporation; Sikaflex -2c SL Self-Leveling, Polyurethane Elastomeric Sealant: www.sikausa.com.

H. Type JS-8 - Butyl Sealant: ASTM C1311; single component, solvent release, non-skinning, non-sagging.
1. Color: To be selected by Architect from manufacturer's full range.
2. Movement Capability: Plus and minus 10 percent.
3. Service Temperature Range: -13 to 180 degrees F (-25 to 82 degrees C).
4. Applications: Use for:
   a. Bedding opening thresholds.
5. Products:
   a. Pecora Corporation; BC-158 Butyl Rubber Sealant: www.pecora.com.

b. Tremco Global Sealants; Tremco Butyl Sealant General Purpose Butyl Sealant: www.tremcosealants.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

I. Type JS-9 - Silicone Sealant: ASTM C920, Grade NS, Class 50, Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, non-bleeding.
1. Color: To be selected by Architect from manufacturer's full range.
2. Movement Capability: Plus and minus 50 percent.
3. Service Temperature Range: -40 to 250 degrees F (-40 to 121 degrees C).
4. Products:
a. Dow Corning Corporation; 795 Silicone Building Sealant: www.dowcorning.com.
b. Momentive Performance Materials, Inc (GE Silicones products); SCS9000 SilPruf NB: www.momentive.com.
c. Pecora Corporation; 864NST Low Modulus Architectural Silicone Sealant - Class 50: www.pecora.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Verify that substrate surfaces are ready to receive work.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

1. Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   b. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      1) Concrete.
   c. Remove laitance and form-release agents from concrete.
   d. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      1) Metal.
      2) Glass.
      3) Glazed surfaces of ceramic tile.

C. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

E. Protect elements surrounding the work of this section from damage or disfigurement.
   1. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
   1. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

F. Install bond breaker where joint backing is not used.
   1. Between sealants and backs of joints.

G. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

H. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
   1. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
      a. Place sealants so they directly contact and fully wet joint substrates.
      b. Completely fill recesses in each joint configuration.
      c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

I. Tool joints concave.
   1. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
      a. Remove excess sealant from surfaces adjacent to joints.
      b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
      c. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
      d. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
      e. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
      f. Use masking tape to protect surfaces adjacent to recessed tooled joints.

J. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

K. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.
   1. Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends,

turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 CLEANING

A. Clean adjacent soiled surfaces.
   1. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect sealants until cured.
   1. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 SCHEDULE

A. Exterior Joints for Which No Other Sealant Type is Indicated: Type JS-9 color as selected by Architect from manufacturer's full range..

B. Control and Expansion Joints in Paving: Type JS-7.

C. Exterior Wall Expansion Joints: Type JS-2 or JS-9 as condition dictates.

D. F. Vertical joints on exposed surfaces of partitions: Type JS-1.

E. Lap Joints in Exterior Sheet Metal Work: Type JS-3.

F. Butt Joints in Exterior Metal Work and Siding: Type JS-3.

G. Joints Between Exterior Metal Frames and Adjacent Work (except masonry):

   Type JS-9.

H. Under Exterior Door Thresholds: Type JS-8.

I. Interior Joints for Which No Other Sealant is Indicated: Type JS-4;.

J. Joints Between Plumbing Fixtures and Walls and Floors, and Between Countertops and Walls: Type JS-5.

K. In STC-Rated Walls, Between Metal Stud Track/Runner and Adjacent Construction, Between Outlet Boxes and Gypsum Board, and as recommended by sealant manufacturer for each condition and intended use: Type JS-6.

END OF SECTION

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SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Wall access door and frame units.

1.3 RELATED REQUIREMENTS

A. Section 09 9000 - Painting and Coating: Field paint finish.

1.4 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. General: The following submittal package shall be submitted as a complete package, including the following listed below. Individual submittals will be returned unaccepted until the complete package is submitted.

C. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
   1. For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

D. Shop Drawings: Indicate exact position of all access door units.
   1. Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
   2. Access Door and Frame Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
   3. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

E. Manufacturer's Installation Instructions: Indicate installation requirements.

F. Project Record Documents: Record actual locations of all access units.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. NFPA 252 or UL 10B for vertical access doors and frames.
   2. ASTM E 119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 PRODUCTS

2.1 ACCESS DOOR AND PANEL APPLICATIONS

A. Walls, Unless Otherwise Indicated:
   1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   2. Size: 12 x 12 inches (300 x 300 mm), unless otherwise indicated.
   3. Tool-operated spring or cam lock; no handle.
   4. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.

B. Walls in Wet Areas:
   1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   2. Size: 12 x 12 inches (300 x 300 mm), unless otherwise indicated.
   3. Tool-operated spring or cam lock; no handle.
   4. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.

C. Fire Rated Walls: See drawings for wall fire ratings.
   1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
   2. Size: 12 x 12 inches (300 x 300 mm), unless otherwise indicated.
   3. Insulated, double skin door panel.
   4. Tool-operated spring or cam lock; no handle.

2.2 WALL AND CEILING UNITS

A. Manufacturers:
   1. Babcock-Davis: www.babcockdavis.com.
   2. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

1. Style: As indicated.
2. Style: Exposed frame with door surface flush with frame surface.
   a. In Gypsum Board: Use drywall bead type frame.
3. Door Style: Single thickness with rolled or turned in edges.
4. Frames: 16 gage, 0.0598 inch (1.52 mm), minimum.
5. Heavy Duty Frames: 14 gage, 0.0747 inch (1.89 mm), minimum.
6. Single Thickness Steel Door Panels: 0.070 inch (1.8 mm), minimum.
7. Heavy Duty Single Thickness Steel Door Panels: 14 gage, 0.0747 inch (1.89 mm), minimum.
8. Double-Skinned Hollow Steel Door Panels: 16 gage, 0.059 inch (1.52 mm), minimum, on both sides and all edges.
9. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly in which they are to be installed.
   a. Provide products listed and labeled by UL as suitable for the purpose specified and indicated.
10. Steel Finish: Primed.
11. Primed Finish: Polyester powder coat; color as selected by Architect from manufacturer's full range.
12. Size(s): As indicated.
13. Hardware:
    a. Hardware for Fire Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    c. Handle: No handle.
    d. Latch/Lock: Cylinder lock operated cam latch, two keys for each unit.
    e. Number of Locks/Latches Required: As recommended by the manufacturer for the size of the unit.
    f. Gasketing: Extruded neoprene, around the perimeter of the door panel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

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

B. Install frames plumb and level in openings. Secure rigidly in place.
   1. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
   2. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

C. Position units to provide convenient access to the concealed work requiring access.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 3313
COILING COUNTER DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Fire-rated coiling counter doors and operating hardware.

1.3 RELATED REQUIREMENTS

A. Division 07 - Section - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Division 08 - Section - Door Hardware: Cylinder cores and keys.

C. Division 09 - Section - Painting and Coating: Field paint finish.

1.4 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

E. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

F. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

H. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.5 SUBMITTALS

A. See Division -01 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish.

C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

D. Samples: Submit two slats, 4 inches long (100 mm long) illustrating shape, color and finish texture.

E. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.

F. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.

G. Project Record Documents: Include as-built electrical diagrams for electrical operation and connection to fire alarm system.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years of experience.

B. Installer Qualifications: Installer Qualifications: Company approved by manufacturer, specializing in performing Work of this section with minimum three years of experience, with IDEA Certified Installers and service technicians on staff.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's two year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Coiling Counter Doors:
   1. Overhead Door Corporation; Product Model 641 Counter Fire Door: www.ohd.com.
   2. Wayne Dalton; Product Firestar Shutter 540: www.wayne-dalton.com.
   3. Substitutions: See Division 01 - Section - Product Requirements.

2.2 COILING COUNTER DOORS

A. Coiling Counter Doors, Fire-Rated: Galvanized steel slat curtain.
   1. Mounting: Exterior face mounted.
   2. Fire Rating: 1-1/2 hour; comply with NFPA 80.
      a. Provide product listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.
   3. Nominal Slat Size: 2 inches (50 mm) wide.
   4. Slat Profile: Flat.
   5. Finish: Factory baked enamel.
   6. Color: As selected by Architect from manufacturer's full colors.
   7. Guides: Formed track; same material and finish unless otherwise indicated.
   8. Hood: Manufacturer's standard; primed steel.
   9. Fire Release Mechanism: Automatically self-closing with governed closing speed, actuated by manufacturer's standard fusible link.
   10. Non-Fire Operation: Manual hand crank lift.
   11. Interior latch with padlock hasp.

2.3 MATERIALS

A. Curtain Construction: Interlocking, single thickness slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with tube to provide reinforcement and positive contact in closed position.
   3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 22 gage, 0.03 inch (0.76 mm).

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
   1. Guides for Galvanized Curtains: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A123/A123M.

C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

D. Latching: Inside mounted, sliding deadbolt.

E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position

and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb. (10 kg) nominal force to operate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

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

B. In addition, install fire-rated doors in accordance with NFPA 80.

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Division 07 - Section - Sealants.

F. Install perimeter trim as indicated.

3.3 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).

C. Maximum Variation From Level: 1/16 inch (1.5 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.4 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3613
SECTIONAL DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Overhead sectional doors, manually and electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.3 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel channel opening frame.

B. Section 06 1000 - Rough Carpentry: Rough wood framing for door opening.

C. Section 07 9005 - Joint Sealers: Perimeter sealant and backup materials.

D. Section 08 7100 - Door Hardware: Lock cylinders.

E. Section 26 0534 - Conduit: Empty conduit from control units to door operator.

F. Section 26 2717 - Equipment Wiring.

1.4 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; 2013.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

G. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; Door & Access Systems Manufacturers' Association, International; 2011.

H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.5 DESIGN / PERFORMANCE REQUIREMENTS

A. 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.

1.6 SUBMITTALS

A. See Section 01 3000 - 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 two panel finish samples, 6 x 6 inch (152 x 152 mm) in size, illustrating color and finish.

E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

F. Operation Data: Include normal operation, troubleshooting, and adjusting.

G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

C. Conform to applicable code for motor and motor control requirements.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission.

D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Overhead Door Corporation: Model 422 www.overheaddoor.com. **BASIS OF DESIGN**.

B. Other Acceptable Manufacturers:
   1. Clopay Corporation; Model 3720: www.clopaydoor.com.
   2. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 STEEL DOOR COMPONENTS

A. Steel Doors: Stile and rail steel with solid and glazed panels; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. 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.
   2. Door Nominal Thickness: 2 inches (50 mm) thick.
   3. Exterior Surface: Flush.
   4. Exterior Finish: Pre-finished with baked enamel of color as selected.
      a. As selected by Architect from manufacturer's full range.
   5. Interior Finish: Pre-finished with baked enamel of color as selected.
   6. Glazed Lights: 4 full glazed lights per panel, one row; set in place with security glazing stops.
   7. Operation: Chain hoist.

B. Door Panels: Stile and rail construction, of steel sheet 0.058 inch (1.5 mm) thick, with welded joints; rabbeted weather joints at meeting rails.

C. Glazing: 1/8 inch (3 mm) double strength glass.

2.3 ALUMINUM DOOR COMPONENTS

A. Aluminum Doors: Stile and rail aluminum with glazed panels; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. 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.
   2. Door Nominal Thickness: 1-3/4 inches (45 mm) thick.
   3. Finish: Anodized, Clear Anodized.
   4. Glazed Lights: 4 glazed lights per panel, one row; set in place with security glazing stops.
   5. Operation: Electric.

B. Door Panels: Paneled aluminum construction; extruded 6063-T6 aluminum stiles and rails; 0.050 inch (1.3 mm) thick infill panels of sheet aluminum; stile and rail joints welded; rabbeted weather joints at meeting rails.

C. Glazing:
   1. 1/4 inch (6 mm) clear tempered glazing as indicated on drawings.
   2. 1/4 inch (6 mm) obscure tempered glazing as indicated on drawings.

2.4 DOOR COMPONENTS

A. Track: Galvanized steel angles, 0.094 inch (2.4 mm) thick; 2-5/16 x 4 inch (59 x 102 mm) size, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) 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 galvanized steel lifting cables.
   1. For Manual Operation: Requiring maximum exertion of 25 lbs (110 N) force to open.
   2. Torsion springs to provide 25,000 cycles, minimum.

D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

F. Head Weatherstripping: EPDM rubber seal, one piece full length.

G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

H. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior handle.

I. Lock Cylinders: Master keyed to building keying system.

2.5 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), 5005 alloy, H14 temper, plain surface.

C. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

D. Metal Primer Paint: Zinc molybdate type.

2.6 ELECTRICAL OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction or UL.

B. Electrical Characteristics:
   1. 1/2 hp (375 W); manually operable in case of power failure, transit speed of 12 inches (300 mm) per second.
   2. 120 volts, single phase, 60 Hz.
   3. Refer to Section 26 2717 - Equipment Wiring: 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 NFPA 70.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

E. Electric Operator: Center mounted draw bar assembly, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.

F. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to stop door upon striking object; hollow rubber covered to provide weatherstrip seal.

G. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
   1. 24 volt circuit.
   2. Surface mounted.
   3. Locate at inside door jamb.

H. Loop Detector and Treadle:

I. Hand Held Transmitter: Digital control, resettable.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.3 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 electrical service. Complete power and control wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9005.

G. Install perimeter trim and closures.

3.4 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm).

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.5 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.

3.6 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.7 PROTECTION

A. Protect installed products from damage during subsequent construction.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

D. Door hardware.

E. Perimeter sealant.

1.3 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Steel attachment members.

B. Section 05 5000 - Metal Fabrications: Steel attachment devices.

C. Section 07 2500 - Weather Barriers: Perimeter air and vapor seal between glazing system and adjacent construction.

D. Section 07 8400 - Firestopping: Firestop at system junction with structure.

E. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.

F. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

G. Section 08 8000 - Glazing: Glass and glazing accessories.

1.4 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).

C. AAMA 612 - Voluntary Specification, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2002.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association; 2009.

E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2011.

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

L. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

O. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2012.

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. General: The following submittal package shall be submitted as a complete package, including the following listed below. Individual submittals will be returned unaccepted until the complete package is submitted.

C. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
   1. For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

D. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
   1. For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
      a. Coordinate and include operable window system as indicated in the drawings.
   2. Include details of provisions for system expansion and contraction, as required.
   3. For entrance doors, coordinate shop drawings with other work.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

H. Fabrication Sample: For each vertical-to-horizontal intersection of aluminum-framed systems, provide isometric drawings showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.

I. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

J. Report of field testing for water leakage.

K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.
   1. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   1. Acceptable to manufacturer and capable of preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

F. Single Source Responsibility: To ensure quality of appearance and performance, obtain materials for each system from either a single manufacturer or from manufacturer approved by each system manufacturer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

H. Pre-Installation Conference: Conduct conference at Project Site.

I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   2. Build mockup of typical wall area as shown on Drawings.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.9 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

B. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.
   1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
      a. Failures include, but are not limited to, the following:
         1) Structural failures including, but not limited to, excessive deflection.
         2) Noise or vibration caused by thermal movements.
         3) Deterioration of metals and other materials beyond normal wear.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Wind-Borne-Debris Resistance Tested, Center-Set Style:
   1. **Basis of Design**: YKK AP America Inc; YHS 50 FI, ProTek.

2. Vertical Mullion Dimensions: 2 inches wide by 5 inches deep (50 mm wide by 127 mm).

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
1. Kawneer: www.kawneer.com.
2. Southern Walls and Windows: www.sowalls.com.

C. Substitution Procedures: See Section 01 6000 - Product Requirements.
1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.2 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

A. Center-Set Style:
1. **Basis of Design**: YKK AP America Inc; YES 40 FS.
2. Vertical Mullion Dimensions: 2 inches wide by 4 inches deep (50 mm wide by 102 mm deep).

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
1. Kawneer: www.Kawneer.com.
2. Southern Walls and Windows: www.sowalls.com.

C. Substitutions: See Section 01 6000 - Product Requirements.
1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.3 BASIS OF DESIGN -- SWINGING DOORS

A. Wind-Borne-Debris Resistance Tested:
1. Basis of Design: YKK AP America Inc; Model 35H, medium stile.
2. Thickness: 2-15/16 inches (75 mm).

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
1. Kawneer: www.kawneer.com.
2. Southern Walls and Windows: www.sowalls.com.

C. Substitutions: See Section 01 6000 - Product Requirements.
1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.4 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing.
   a. At exterior storefront system.
2. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing.

a. At interior storefront system.
3. Finish: Natural anodized with organic seal.
   a. Factory finish all surfaces that will be exposed in completed assemblies.
   b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
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. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:
1. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   a. Movements of supporting structure indicated on Drawings including, but not limited to deflection from uniformly distributed and concentrated live loads.
   b. Dimensional tolerances of building frame and other adjacent construction.
   c. Failure includes the following:
      1) Deflection exceeding specified limits.
      2) Thermal stresses transferring to building structure.
      3) Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      4) Noise or vibration created by thermal and structural movements.
      5) Loosening or weakening of fasteners, attachments, and other components.
      6) Sealant failure.
      7) Failure of operating units.
2. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7.

b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

3. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, tested by independent agency in accordance with ASTM E1996 for Wind Zone 4, Basic Protection, for Large and Small Missile impact and pressure cycling at design wind pressure.
4. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 12 lbf/sq ft (575 Pa).
5. Deflection of Framing Members Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
6. Air Leakage: Maximum of 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 pounds per square foot (300 Pa) pressure differential across assembly.
7. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures.
   a. Temperature Change (Range): 32 deg F (0 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.
8. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
9. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
   a. Sound Transmission Class (STC): Minimum 35 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

2.5 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing stops: Flush.
   3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: As specified in Section 08 8000.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: 4 inches (100 mm) wide.
   3. Vertical Stiles: 4-1/2 inches (115 mm) wide.
   4. Bottom Rail: 10 inches (254 mm) wide.
   5. Glazing Stops: Square.

D. Operable Sash: Aluminum project-out awning; finished to match storefront; turn handle latch with manufacturer's standard insect screen.
   1. Win-Vent Architectural Windows; Series 800: www.winventwindows.com.
      a. Window Style: Double Casement.
      b. Casement window to be set within the storefront framing system as indicated on the drawings. Coordinate with storefront manufacturer for installation in the field.

2.6 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Fasteners: Stainless steel.

E. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

F. Concealed Flashings: 0.018 inch (0.5 mm) thick aluminum.

G. Perimeter Sealant: Type JS-9 specified in Section 07 9005.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Glazing Accessories: As specified in Section 08 8000.

J. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

K. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.7 FINISHES

A. Natural Anodized Finish with Organic Seal: AAMA 612 Clear anodic coating with non-aqueous electro-deposited organic seal; not less 0.7 mils (0.018 mm) thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.8 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
   1. Finish on Hand-Contacted Items: Polished chrome.
   2. For each door, include push handle, pull handle, exit device, narrow stile handle latch, closer, and continuous hinge.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify dimensions, tolerances, and method of attachment with other work.

C. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
   1. Do not install damaged components.
   2. Fit joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure non-movement joints.
   4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   5. Seal joints watertight, unless otherwise indicated.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
   1. Metal Protection:
      a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
   1. Install components plumb and true in alignment with established lines and grades, without warp or rack.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Install operating sash.

K. Entrances: Install to produce smooth operation and tight fit at contact points.
   1. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

L. Set thresholds in bed of mastic and secure.

M. Install hardware using templates provided.
   1. See Section 08 7100 for hardware installation requirements.

N. Install glass in accordance with Section 08 8000, using glazing method required to achieve performance criteria.

O. Install perimeter sealant in accordance with Section 07 9005.

P. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

A. Test installed storefront for water leakage in accordance with AAMA 501.2.

B. Repair or remove work where inspections indicate that it does not comply with specified requirements.

C. Additional inspection, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Aluminum-framed assemblies will be considered defective if they do not pass inspections.

E. Prepare inspection reports.

3.5 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

1. As recommended by manufacturer.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 5400
ALUMINUM CLAD WINDOWS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Factory fabricated aluminum clad windows with operating sash.

B. Operating hardware.

C. Insect screens.

1.3 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Perimeter air and vapor seal between composite window frame and adjacent construction.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 8000 - Glazing.

1.4 REFERENCE STANDARDS

A. American Architectural Manufacturers Association (AAMA):
1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
5. AAMA 612 Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum.

B. American Society for Testing and Materials (ASTM):
1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
2. ASTM C 1036 - Flat Glass.

3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
6. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
7. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
8. ASTM E 283 - Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
9. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
10. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
11. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
12. ASTM E 1886 - Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
13. ASTM E 1996 - Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
14. ASTM G 85 - Modified Salt Spray (Fog) Testing.

C. Screen Manufacturers Association (SMA):
1. SMA 1201 - Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.

D. Window and Door Manufacturers Association (WDMA):
1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for windows, doors and skylights
2. WDMA I.S.4 - Industry Specification for Preservative Treatment for Millwork.

1.5 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog data and component dimensions, anchorage and fasteners, glass and internal drainage details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work and installation requirements.

D. Submit two samples 12 x 12 inches in size illustrating window frame section, mullion section, screen and frame, factory finished surfaces, glazing, infill panels, , and glazing materials.

E. Performance Validation: Submit certified label or test report on products as indicated under performance requirements to validate product compliance.

F. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Requirements: consult local code for IBC International Building Code 2015 year and pertinent revisions for information on:

1. Egress, emergency escape and rescue requirements
2. Basement window requirements
3. Windows fall prevention and/or window opening control device requirements.

1.7 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. Deliver in original packaging and protect from weather

1. Store window units in an upright position in a clean and dry storage area above ground to protect from weather under provision of Section 01 66 00

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.9 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide ten year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

PART 2 PRODUCTS

A.1 MANUFACTURERS

A. Aluminum Clad Windows:
   1. Pella Corporation, 102 Main Street, Pella, Iowa 50219. **Basis of Design**
      a) Model: Pella Architect Series® Traditional LX Hung – HurricaneShield® Impact-Resistant Glazing
   2. Andersen Windows, Inc; www.andersenwindows.com/sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Frame:
   1. Select softwood, water-repellent, preservative-treated in accordance with WDMA I.S.-4.
   2. Interior Exposed Surfaces: [Clear Pine] [Mahogany] [Douglas Fir] with no visible fastener holes.
   3. Exterior Surfaces: Clad with aluminum.
   4. Overall Frame Depth: 5-7/8 inches (149 mm).

C. Sash:
   1. Select softwood, water- water-repellent, preservative-treated in accordance with WDMA I.S.-4.
   2. Interior Exposed Surfaces: Douglas Fir with no visible fastener holes.
   3. Exterior Surfaces: Clad with aluminum, lap-jointed at corners.
   4. Corners: Mortised and tenoned, glued and secured with metal fasteners.
   5. Operable sash tilt to interior for cleaning or removal.
   6. Sash Thickness: 2-1/4 inches (57 mm).

D. Weather Stripping:
   1. Water-stop santoprene wrapped foam at head and sill.
   2. Thermal-plastic elastomer bulb with slip coating set into lower sash for tight contact at checkrail.
   3. Vinyl-wrapped foam inserted into jambliner or jambliner components to seal to sides of sash.
   4. Bristle strip on the lower jamb insert.

2.2 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 08 8000 and of types as indicated.

2.3 OPTIONS

A. Insect Screens: Standard half.
   1. Compliance: ASTM D 3656 and SMA 1201.
   2. Screen Cloth: Vinyl-coated fiberglass, 18/16 mesh.
   3. Set in aluminum frame fitted to inside of window.
   4. Complete with necessary hardware.
   5. Screen Frame Finish: Baked enamel.
      a) Color: Finish to match exterior window cladding.

2.6 HARDWARE

A. Balances:
   1. Block-and-tackle balances.
   2. Balances are attached to frame and connected to sash with polyester cord.

C. B. Locking System:
   1. Self-aligning cam-action sash lock factory-installed.
   2. Two locks on all units with frame width of 37 inches or greater.

C. Sash Lifts:
   1. Sash lift furnished for field installation.
   2. One sash lift on units with frame width less than 37 inches, 2 sash lifts on units with frame

D. Lock and Sash Lift Finish:
   1. As selected by Architect from manufacturers full line of colors.

2.7 FINISH

A. Exterior Finish System: Pella EnduraClad.(Basis of Design)
   1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
      a) Clean and etch aluminum surface of oxides.
      b) Pre-treat with conversion coating.
      c) Top coat with baked-on polyester enamel.
      d) Color: As selected by Architect from manufacturer's full range of colors.
   2. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2603 and the following performance requirements of AAMA 2605:
      a) Dry Film Hardness: Eagle Turquoise Pencil, H minimum.

b) Film Adhesion: 1 mm crosshatch, dry, wet, boiling water.

c) Impact Resistance: 1/10-inch distortion, no film removal.

d) Chemical Resistance: 10 percent Muriatic acid, 15 minutes. Mortar pat test, 24 hours.

e) Detergent Resistance: 3 percent at 100 degrees F, 72 hours.

f) Corrosion Resistance: ASTM G85-A5, 2000 hours. Humidity, 3,000 hours. Salt spray exceeds 3,000 hours.

B. Exterior Finish System: Pella EnduraClad Plus.

1. Exterior aluminum surfaces shall be finished with the following multi-stage system:

a) Clean and etch aluminum surface of oxides.

b) Pre-treat with chrome phosphate conversion coating.

c) Pre-treat with chromic acid sealer/rinse.

d) Top coat with baked-on 70% fluoropolymer-based enamel.

2. Color: As selected by Architect from manufacturer's full range of colors..

3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2605.

C. Exterior Finish System: Pella Anodized Aluminum

1. Exterior aluminum surfaces shall be finished with the following multi-stage system:

a) Clean and etch aluminum surface of oxides.

b) Pre-treat with chrome phosphate conversion coating.

c) All exposed surfaces should receive an architectural anodized finish in conformance with Aluminum Association Standard AAMA 611 and AAMA 612.

2. Color: As selected by Architect from manufacturer's full range of colors.

D. Interior Finish: Factory finished with 1 prime coat and 1 top coat of Color: As selected by Architect from manufacturer's full range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install windows in accordance with manufacturer's instructions and approved shop drawings.

B. Install windows to be weather-tight and freely operating.

C. Maintain alignment with adjacent work.

D. Secure assembly to framed openings, plumb and square, without distortion.

E. Integrate window system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with window manufacturer's instructions.

F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using [backer rod and sealant] [insulating-foam sealant].

G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

H. Leave windows closed and locked.

3.3 FIELD QUALITY CONTROL

A. Field Testing: Field water testing shall be conducted in accordance with ASTM E1105 Test Procedure B. The test pressure shall be based on the maximum positive components and cladding design pressure. Utilizing the AAMA 502 field test reduction, the water test pressure is 10% of the maximum positive design pressure.

3.4 CLEANING

A. Clean window frames and glass in accordance with Division 1 requirements.

B. Do not use harsh cleaning materials or methods that would damage finish.

C. Remove labels and visible markings.

3.5 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

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SECTION 08 8000
GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Glass.

B. Plastic glazing film.

C. Glazing compounds and accessories.

1.3 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers.

B. Section 07 9005 - Joint Sealers: Sealant and back-up material.

C. Section 08 1113 - Hollow Metal Doors and Frames: Glazed doors and borrowed lites.

D. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

E. Section 08 4013 - Fire-Rated Glazed Walls: Glazing fire-tested as part of the wall assembly.

F. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished by storefront manufacturer.

G. Section 08 8300 - Mirrors.

H. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.4 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

D. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2009e1.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

J. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

K. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

L. ICC (IBC) - International Building Code; 2012.

1.5 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

E. Deterioration of Coated Glass: Defects developed from normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

F. Deterioration of Laminated Glass: Defects developed from normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.6 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Design Loads for glazing system, components and cladding wind loads determined in accordance with ASTM E 1996, for the parameters specified.
   1. Design Loads: Refer to structural drawings.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
   3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Specified Design Wind Loads: As indicated on structural drawings, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
      b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      c. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
      d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
      e. Windborne-Debris-Impact-Resistance-Test Performance: Provide glazing for aluminum-framed systems that pass large and small missile-impact tests and cyclic-pressure tests according to the requirements of The International Building Code.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch- (12.7-mm) wide interspace.

3. For laminated-glass lites, properties are based on products of construction indicated.

F. Impact Resistance: System to meet requirements for coastal hurricane missile impact loads.
   1. Glazed aluminum curtain wall up to 30 feet above grade shall be designed for Large Missile Impact (LMI) in accordance with ASTM E 96 and SSTD 12.
   2. Glazed aluminum curtain wall frame 30 feet to 60 feet above grade shall be designed for Small Missile Impact (SMI) in accordance with ASTM E 96 and SSTD 12.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.8 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. General: The following submittal package shall be submitted as a complete package, including the following listed below. Individual submittals will be returned unaccepted until the complete package is submitted.

C. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

D. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

E. Samples: Submit two samples 12 x 12 inch (305 x 305 mm) in size of glass units, showing coloration and design.

F. Glazing Schedule: Use same designations indicated on Drawings.

G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

H. Certificates: Certify that products meet or exceed specified requirements.
   1. Tinted/coated float glass.
   2. Glazing sealants.
   3. Glazing gaskets.

I. Manufacturer's Certificate: Certify that sealed insulated glass meets or exceeds specified requirements.

J. Warranties: Sample of special warranties.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods. Maintain one copy on site.

B. Manufacturer/Fabricator Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer. Manufacturer/Fabricator to provide references and submit project experience documentation demonstrating that they have successfully completed a number of significant projects that have incorporated high-performance, low-e coated glass products.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.
   1. An experienced installer who has completed glazing similar in material, design and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association’s Program.

D. Source Limitations for Glass: Obtain tinted float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.

E. Glass Distortion Standard for heat-treated glass sized 6.0 mm or thicker:
   1. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed.003 center/.008 edges.
   2. Millidiopter: 90 percent of surface not to exceed +/- 120 millidiopters.
   3. Monitoring: Every lite measured with an on-line distortion measurement system.
   4. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C1048.
   5. All documentation shall be recorded and available to the Architect upon request.

F. Insulated Glass Unit Standard for insulated glass unit integrity:
   1. Insulated Glass Unit Seal/Sealant
      a. A "Butterfly Unit Adhesion Pull Test" shall be performed at every shift or carton change. This test is to check the adhesion of the primary sealant to the spacer and the glass.
      b. The center air space is to be measured every hour to help prevent concave/convex insulating glass units.
   2. Sealant/Application Types
      a. Insulated glass units can have no skips or voids in the primary or secondary seals.
      b. The fabricator must be able to meet architectural aesthetic requirements for primary and secondary seals.

c. All documentation shall be recorded and available to the Architect upon request.

G. Color Quality Standards:
1. Manufacturing Facilities
a. Manufacturer will employ stringent quality control procedures to ensure the coated glass delivered to their certified network of glazing system fabricators is of the highest standard.
b. These procedures will include the use of both on-line continuous color measurements as well as regular quality control checks using off-line measurement instrumentation.
c. Tolerances for color variation will be less than as prescribed in ASTM C1376.
2. Certified Fabricators
a. Color measurements will be preformed to ensure compliance to ASTM C1376 and will be conducted in accordance with the fabricator's documented quality control procedure.

H. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants and provide results to the Architect for review.

I. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
1. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

J. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."

K. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council (IGCC).

1.10 MOCK-UP

A. Provide mock-up of installed storefront and window systems including glass and air barrier and vapor retarder seal.
1. Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

2. Install glazing in mock-ups specified in Division 08 "Alumiinum-Framed Storefronts" to match glazing systems required for Project, including glazing methods.

B. Locate where directed by Architect.

C. Mock-up may remain as part of the Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.12 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

B. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).

C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.13 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
   1. Refer to "Definitions" in this specification section.
   2. Warranty period begins from the date of Substantial Completion.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.
   1. Refer to "Definitions" in this specification section.
   2. Warranty period begins from the date of Substantial Completion.

D. Coated-Glass Products: Provide a ten (10) year warranty to include coverage for deterioration, including replacement of failed units.
   1. Refer to "Definitions" in this specifiction section.
   2. Warranty perid begins from the date of Substantial completion.

PART 2 PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
   1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
   1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
   2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLAZING TYPES

A. Type IG-1 - Sealed Insulating Glass Units: Vision glazing, low-E.
   1. Application(s): All exterior glazing unless otherwise indicated.
   2. Substitutions: Refer to Section 01 6000 - Product Requirements.
      a. Other products of the basis of design manufacturer and products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
      b. Architect's decision on substitutions is final.

3. Between-lite space filled with air.
4. Thermal Resistance (U-Value): 0.28, maximum.
5. Total Solar Heat Gain Coefficient: 0.27, maximum.
6. Total Visible Light Transmittance: 64 percent, maximum.
7. Basis of Design: PPG Industries, Inc: www.ppgideascapes.com.
8. Outboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum.
   a. Coating: PPG Solarban 70XL on #2 surface, no coating on #3 surface.
   b. Tint: Atlantica (light green).
9. Inboard Lite: Heat-strengthened, laminated float glass, 1/2 (nominal) inch (13.6 mm) thick.
   a. Tint: None (clear).
10. Total Thickness: 1-5/16 inch (33.3 mm).

B. Type IG-2 - Sealed Insulating Glass Units: Spandrel glazing.
1. Application: Exterior glazing where indicated.
2. Outboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum.
   a. Tint: Same as on vision units.
   b. Coating: Same as on vision units, on #2 surface.
3. Inboard Lite: Heat-strengthened, laminated float glass, 1/2 (nominal) inch (13.6 mm) thick.
   a. Tint: Clear.
   b. Opacifier: Elastomeric coating, on #4 surface.
   c. Opacifier Color: To be selected by Architect from manufacturer's full range.
4. Total Thickness: 1-5/16 inch (33.3 mm).
5. Glazing Method: Gasket glazing.

C. Type S-2 - Fire-Protection-Rated Glazing:
1. IBC Fire Protection Rating: D-H-45, minimum.
2. Safety Certification: 16 CFR 1201 Category II.
3. Applications: Provide this type of glazing in the following locations:
   a. Glazed lites in fire doors.
   b. Sidelights, borrow lites, and other glazed openings in partitions indicated as having an hourly fire rating.
   c. Other locations indicated on the drawings.
4. Thickness: 1/4 inch (6 mm).
5. Light Transmittance: 91 percent, nominal.
6. Solar Heat Gain Coefficient: 1.03 percent, nominal.
7. Glazing Method: As required for fire rating.

D. Type S-3 - Single Safety Glazing: Non-fire-rated.
1. Applications: Provide this type of glazing in the following locations:
   a. Glazed lites in doors, except fire doors.
   b. Glazed sidelights to doors, except in fire-rated walls and partitions.
   c. Glazed view windows and panels in partitions enclosing athletic activity rooms, except in fire-rated walls and partitions.
   d. Other locations required by applicable federal, state, and local codes and regulations.
   e. Other locations indicated on the drawings.

2. Type: Fully tempered float glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm).
5. Light Transmittance: 91 percent, nominal.
6. Solar Heat Gain Coefficient: 1.03 percent, nominal.
7. Glazing Method: Interior dry method, tape and tape.

2.3 EXTERIOR GLAZING ASSEMBLIES

A. Structural Design Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Glass thicknesses listed are minimum.

B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.
   2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
   3. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.4 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Glass Company North America, Inc: www.us.agc.com.
   2. Guardian Industries Corp: www.sunguardglass.com.
   3. PPG Industries, Inc: www.ppgideascapes.com.
   4. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
   2. Plastic Interlayer: 0.060 inch (1.52 mm) thick, minimum.
   3. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.

D. Fire-Protection-Rated Glazing: Type, thickness, and configuration as required to achieve indicated ratings.
   1. IBC Fire Protection Rating: As indicated on drawings.
   2. Provide products listed by Underwriters Laboratories.
   3. Safety Certification: 16 CFR 1201 Category II.
   4. Labeling: Provide permanent label on each piece giving the IBC rating and other information required by the applicable code.
   5. "NT-Rated" Products: Where D-H-90 (or D-H-NT-90), D-H-60 (or D-H-NT-60), D-H-45 (or D-H-NT-45), D-H-20 (or D-H-NT-20), or any OH- rating is indicated, provide one of the following products or any specified T-rated product of equal or higher numerical rating:
      a. SCHOTT North America Inc; Pyran Platinum F (film): www.us.schott.com.
      b. Technical Glass Products; Firelite NT: www.fireglass.com.
      c. Vetrotech Saint-Gobain North America; Keralite F (film): www.vetrotechusa.com.
      d. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.5 SEALED INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Any fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty, if any.
   3. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
   1. Locations: Exterior, except as otherwise indicated.
   2. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   3. Edge Spacers: Aluminum, bent and soldered corners.
   4. Edge Seal: Glass to elastomer with supplementary silicone sealant.
   5. Edge Seal Color: Black.
   6. Purge interpane space with dry hermetic air.

2.6 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.

B. Polyurethane Sealant (Type JS-1): Single component, chemical curing, non-staining, non-bleeding; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; Shore A Hardness Range 20 to 35; color as selected by Architect from manufacturer's full range.

C. Silicone Sealant (Type JS-9): Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected by Architect from manufacturer's full range.

2.7 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness of 5 to 30 Durometer Shore "A"; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.
   3. Spacer Rod Diameter: As required for application.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; standard color.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealant in accordance with manufacturer's instructions.

3.3 GLAZING METHODS

3.4 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.6 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.7 MANUFACTURER'S FIELD SERVICES

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.8 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.9 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 8300
MIRRORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Glass mirrors.

1.3 RELATED REQUIREMENTS

A. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Metal-framed mirrors.

1.4 REFERENCE STANDARDS

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

F. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

G. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

H. GANA (TIPS) - Mirrors Handle with Extreme Care: Tips For the Professional on the Care and Handling of Mirrors; National Association of Mirror Manufacturers; 2004 (http://www.mirrorlink.org/members/technical.h

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.
   1. Maintain one copy on project site.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS) "Mirrors Handle with Extreme Care: Tips For the Professional on the Care and Handling of Mirrors."

1.7 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mirror Glass - General: Select materials and/or provide supports as required to limit mirrored glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear tempered safety type with copper and silver coating, organic overcoating, bevelled edges, 6 mm thick minimum.
   1. 96 inch (2438 mm) wide x 72 inch (1829 mm) high nominal.

2.2 GLAZING COMPOUNDS

A. Polyurethane Sealant Type JS-1: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35; color as selected by Architect from manufacturer's full range.

B. Silicone Sealant Type JS-9: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component; chemical curing; non-bleeding, non-staining, cured Shore A hardness of 15 to 25; color as selected by Architect from manufacturer's full range.

2.3 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; on release paper.

D. Glazing Clips: Manufacturer's standard type.

E. Mirror Attachment Accessories: Stainless steel J-profile channels.

F. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive mirrors.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Perform installation in accordance with ASTM C1193 for solvent release sealants. Install sealant in accordance with manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install mirrors in accordance with GANA recommendations.

B. Set mirrors plumb and level, free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.4 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

3.5 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. This section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
   1. Broadloom carpet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.
   4. Vinyl Composition Tile.
   5. Luxury Vinyl Tile.
   6. Rubber Sport Floor
   7. Resinous Flooring.

B. Preparation of new concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and pH.

D. Remediation of concrete floor slabs due to unsatisfactory moisture or pH conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

1.3 RELATED REQUIREMENTS

A. Section 01 2200 - Unit Prices: Bid pricing for remediation treatments if required.

B. Section 01 4000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

C. Section 03 3000 - Cast-In-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

D. Section 03 3000 - Cast-In-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

E. Section 03 5400 - Cast Underlayment: Self-leveling underlayment applied as remediation treatment.

1.4 PRICE AND PAYMENT PROCEDURES

A. Unit Prices: See Section 01 2200 - Unit Prices.

B. Unit Price for Alternate Flooring Adhesive: Do not include the cost of the alternate adhesive in the base bid; state on the bid form the unit price per square foot (square meter) for using the alternate adhesive, in the event such remediation is required.

C. Unit Price for Remedial Floor Coating: Do not include the cost of the floor coating in the base bid; state on the bid form the unit price per square foot (square meter) for the floor coating, installed, in the event such remediation is required.
   1. Base the unit price on the assumption that the floor area to be treated is primarily open, not divided into rooms and corridors.

1.5 REFERENCES

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.7 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and pH limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Testing Agency's Report: Include:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and pH test reports.
   4. Copies of specified test methods.

5. Recommendations for remediation of unsatisfactory surfaces.
6. Include certification of accuracy by authorized official of testing agency.
7. Submit report directly to Owner.
8. Submit report not more than two business days after conclusion of testing.

C. Adhesive Bond and Compatibility Test Report.

D. Copy of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.

E. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   3. Manufacturer's installation instructions.
   4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.8 QUALITY ASSURANCE

A. Moisture and pH testing will be performed by an independent testing agency employed and paid by Owner.

B. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

C. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.10 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of pH found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: 1/8 inch (3.2 mm), maximum.
   2. If testing agency recommends any particular products, use one of those.
   3. Products:
      a. Advanced Moisture Control, Inc.; Vapor-Green FC: www.vaporsafe.com.
      b. Concrete Curative Systems; CCS-SI: www.concretecurative.com.
      c. Synthetics International; Synthetics 30: www.syntheticsintl.com
      d. Substitutions: See Section 01 6000 - Product Requirements.
   4. Moisture Sealer (if required): Provide a synthetic polymer formulation made specifically for concrete moisture and alkalinity control applications where slab surfaces are intended to receive floor covering.
   5. The moisture sealer shall penetrate and seal concrete substrate to bring vapor emission and relative humidity into compliance for the safe installation of the floor covering specified.
   6. Approximate Spread Rates: 100 to 200 square feet per gallon, depending on the moisture levels.
   7. Performance:
      a. ASTM E 96: Water Vapor Transmission Rate from 80 to 99.5 percent reduction capability.
      b. ASTM D 1308: Acid/Alkali Resistance: 14 pH.

c. ASTM F 1869: Calcium Chloride Test < 3.0 pounds per 1,000 square feet per 24 hours.
d. ASTM F 2170: Relative Humidity Test (In-situ) resistant to 100 percent RH.
e. VOC: 70 g/L or less.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:
1. Preliminary cleaning.
2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. pH tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.
3. Excessive pH: If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.3 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.

F. Report: Report the information required by the test method.

3.4 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.5 PH TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Note: This procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range pH paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the pH paper into the water, remove it, and compare immediately to chart to determine pH reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value is over 10.

3.6 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.7 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.8 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.9 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Gypsum wallboard.

G. Joint treatment and accessories.

H. Textured finish system.

I. Water-resistive barrier over exterior wall sheathing.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 4000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

C. Section 07 2100 - Thermal Insulation: Acoustic insulation.

D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.

F. Section 07 9005 - Joint Sealers: Acoustic sealant.

G. Section 09 2216 - Non-Structural Metal Framing.

H. Section 09 3000 - Tiling (Tile): Tile backing board.

1.4 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2013.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.

I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007 (Reapproved 2013).

J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2010a.

K. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

L. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.

M. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing; 2013.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

O. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2014.

P. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

S. ASTM E413 - Classification for Rating Sound Insulation; 2010.

T. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.

U. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

V. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2012.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Test Reports: For all stud framing products that do not comply with ASTM C645 or C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.

2.2 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC; Product ProSTUD- 33 mil: www.clarkdietrich.com.
   2. Marino; Product Viper Stud- 33 mil: www.marinoware.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (240 Pa).
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
   5. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through one leg only.
      a. Manufacturers - Resilient Furring Channels:
         1) Same manufacturer as other framing materials.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
      b. Acceptable Products:
         1) "Posi Clip" by Fire Trak Corporation.
         2) "The System" by Metal-Lite, Inc.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Georgia-Pacific Gypsum: www.gpgypsum.com.
   2. National Gypsum Company: www.nationalgypsum.com.
   3. USG Corporation: www.usg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Ceilings: 5/8 inch (16 mm).
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   5. Paper-Faced Products:
      a. Georgia-Pacific Gypsum; ToughRock.
      b. USG Corporation;.
      c. National Gypsum Co.;.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   6. Mold-Resistant Paper-Faced Products:
      a. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
      b. National Gypsum Company; Gold Bond XP Gypsum Board.
      c. USG Corporation; SHEETROCK Brand HUMITEK panels.

C. Abuse-Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Glass Mat-Faced Type: Gypsum wallboard as defined in ASTM C1658/C1658M.
   4. Type: Fire-resistance rated Type X, UL or WH listed.
   5. Thickness: 5/8 inch (16 mm).
   6. Edges: Tapered.
   7. Products:
      a. USG Corporation; Mold Tough AR Fire-Code Abuse-Resitant Gypsum Panels.
      b. National Gypsum Co.; Goldbond XP AR Wallboard.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, and shower ceilings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
      a. Standard Type: Thickness 1/2 inch (12.7 mm).
      b. Products:
         1) Georgia-Pacific Gypsum; DensShield Tile Backer.
         2) National Gypsum Company; Gold Bond eXP Tile Backer.
         3) Substitutions: See Section 01 6000 - Product Requirements.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Core Type: Type X, as indicated.
5. Type X Thickness: 5/8 inch (16 mm).
6. Edges: Square, for vertical application.
7. Glass Mat Faced Products:
   a. Georgia-Pacific Gypsum; DensGlass Sheathing.
   b. National Gypsum Company; Gold Bond eXP Sheathing.
   c. USG Corporation; Securock.
   d. Substitutions: See Section 01 6000 - Product Requirements.

2.4 ACCESSORIES

A. Acoustic Insulation: ASTM C665; mineral wool batt, friction fit type, unfaced.
   1. Locate as indicated on the drawings.
   2. Thickness: 3 inches (76 mm).
   3. Wall System STC Rating: 45, similar to U.L. Design No. V417.
   4. Manufacturers:
      a. Thermafiber; Sound Attenuation Fire Blankets (SAFB): www.thermafiber.com.
      b. Roxul, Inc.; Acoustical Fire Batt (AFB): www.rspec.com.
      c. Johns Manville International, Inc.; MinWool Sound Attenuation Fire Batts: www.jm.com.

B. Acoustic Sealant: As specified in Section 07 9005.

C. Finishing Accessories: ASTM C1047, galvanized steel, unless otherwise indicated.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead and L-bead at exposed panel edges.

D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.
   3. Chemical hardening type compound.

E. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

F. Textured Finish Materials: Latex-based compound; plain.

G. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

H. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete, masonry, and plastered walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 16 inches (406.4 mm) on center.
   1. Orientation: Vertical.
   2. Spacing: At 16 inches (400 mm) on center.

F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.

G. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

H. Blocking: Install mechanically fastened steel sheet blocking for support of:

1. Wall mounted cabinets.
2. Plumbing fixtures.
3. Toilet partitions.
4. Toilet accessories.
5. Wall mounted door hardware.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.4 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.

G. Installation on Metal Framing: Use screws for attachment of all gypsum board.

H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.6 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   6. Level 0: Temporary partitions and surfaces indicated to be finished in later stage of project.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling and sanding is not required at base layer of double layer applications.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.7 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.8 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 1000 - Concrete Forming and Accessories: Placement of special anchors or inserts for suspension system.

C. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

D. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

1.4 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2008e1.

E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.

1.5 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.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 x 6 inch (152 x 152 mm) in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 12 inches (305 mm) long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.7 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.

2. CertainTeed Corporation: www.certainteed.com.
3. USG: www.usg.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
1. Same as for acoustical units.

2.2 ACOUSTICAL UNITS

A. Acoustical Panels Type ACT 1: Vinyl faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
1. VOC Content: Certified as Low Emission by one of the following:
a. GreenGuard Children and Schools; www.greenguard.org.
b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.
2. Size: 24 x 24 inches (600 x 600 mm).
3. Thickness: 3/4 inches (19 mm).
4. Composition: Wet felted.
5. Light Reflectance: 89 percent, determined in accordance with ASTM E1264.
6. NRC Range:.70 to N/A, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): Up to 35, determined in accordance with ASTM E1264.
8. Edge: Shadowline.
9. Surface Color: White.
10. Surface Pattern: Non-directional fissured.
11. Suspension System: Exposed grid (9/16 inch).
12. Products:
a. USG; Mars ClimaPlus- Item No. 86985. **BASIS OF DESIGN.**
b. Armstrong World Industries, Inc.; Ultima- Item No. 1912, Beveled Tegular.
c. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Panels Type ACT 2: Vinyl faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
1. VOC Content: Certified as Low Emission by one of the following:
a. GreenGuard Children and Schools; www.greenguard.org.
b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.
2. Size: 24 x 24 inches (600 x 600 mm).
3. Thickness: 3/4 inches (19 mm).
4. Composition: Wet felted.
5. Light Reflectance: 89 percent, determined in accordance with ASTM E1264.
6. NRC Range:.70 to N/A, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): Up to 35, determined in accordance with ASTM E1264.
8. Edge: Square.
9. Surface Color: White.
10. Surface Pattern: Non-directional fissured.
11. Suspension System: Exposed grid (15/16 inch).
12. Products:

a. USG; Mars ClimaPlus- Item No. 86185. **BASIS OF DESIGN.**
b. Armstrong World Industries, Inc.; Ultima- Item No. 1910, Beveled Tegular.
c. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Panels Type ACT 3: Vinyl-Faced, highly durable gypsum panel.
1. VOC Content: Certified as Low Emission by one of the following:
a. GreenGuard Children and Schools; www.greenguard.org.
b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.
2. Size: 24 x 24 inches (600 x 600 mm).
3. Light Reflectance: 77 percent, determined in accordance with ASTM E1264.
4. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
5. Panel Edge: Square.
6. Surface Pattern: Smooth-textured panel.
7. Surface Color: White.
8. Suspension System: Exposed grid (15/16 inch).
9. Products:
a. USG; SHEETROCK Lay-in Ceiling Panel ClimaPlus.
b. Cetainteed Ceilings; Performa Vinylrock.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.3 SUSPENSION SYSTEM(S)

A. Manufacturers:
1. Armstrong World Industries, Inc: www.armstrong.com.
2. USG: www.usg.com.
3. CertainTeed Ceilings: www.certainteed.com/ceilings.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System Type ACT 1: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 9/16 inch (14 mm) wide face.
2. Construction: Double web.
3. Finish: White painted.
4. Products:
a. Manufacturers:
1) USG/Donn; Centricitee DXT.
2) Armstrong; Suprafine.
b. Substitutions: See Section 01 6000 - Product Requirements.

D. Exposed Steel Suspension System Type ACT 2: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
2. Construction: Double web.

3. Finish: White painted.
4. Products:
   a. Manufacturers:
      1) USG/Donn; DX/DXL.
      2) Armstrong; Prelude.
   b. Substitutions: See Section 01 6000 - Product Requirements.

E. Exposed Steel Suspension System Type ACT 3: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
2. Construction: Double web.
3. Finish: White painted.
4. Products:
   a. Manufacturers:
      1) USG/Donn; DX/DXL.
      2) CertainTeed; Classic.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. 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

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. 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.

G. 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.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

3.3 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 units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

C. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.4 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2010).

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.5 SUBMITTALS

A. See Section 01 3000 - 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. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, 12 x 12 inch (304.8 x 304.8 mm) in size illustrating color and pattern for each resilient flooring product specified.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 1 box of tile for every 50 boxes of tile or fraction thereof, of each type, color and pattern of floor tile installed.
   3. Extra Wall Base: 100 linear feet (31 linear meters) of each type and color.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer to provide limited warranty for transition strips. The warranty period shall be a minimum of 5 years after substantial completion.

B. Manufacturer's Warranty: Manufacturer to provide warranty for resilient tile flooring. The warranty period shall be a minimum of 6 years after substantial completion.

C. Special Project Warranty: Submit flooring Installer's Warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, for the following warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SHEET FLOORING

2.2 TILE FLOORING (BASE BID)

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness, and:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Size: 12 x 12 inch (305 x 305 mm).
   3. VOC Content Limits: As specified in Section 01 6116.
   4. Thickness: 0.125 inch (3.2 mm).
   5. Pattern: Solid color.
   6. Manufacturers:
      a. Armstrong World Industries, Inc; Product Excelon Chromaspin: www.armstrong.com. **BASIS OF DESIGN**.
      b. Mannington Mills, Inc; Product Touchstone: www.mannington.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   7. Material:
      a. **BASIS OF DESIGN**: As indicated on the drawings. No alterations or substitutions. No exceptions without approval of the Architect.
         1) VCT 1: As indicated on the drawings.
         2) VCT 2: As indicated on the drawings..
         3) VCT 3: As indicated on the drawings.
      b. Alternate to Basis of Design: These selections are to be used together as indicated on the drawings. No alterations or substitutions. No exceptions without the approval of the Architect.
         1) VCT 1-ALT: Carbonite 54802.
         2) VCT 2-ALT: Paynes Gray 54801.
         3) VCT 3- ALT: Brilliant Orange 54820.
         4) VCT 4- ALT: Carminelle 54822.

2.2 TILE FLOORING (ALTERNATE #1)

A. Material listed below are to be used to establish the Add Alternate #1 ONLY.

B. Luxury Vinyl Tile: Surface pattern type, and:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Size: 18 x 36 inch (457 x 914 mm).
   3. VOC Content Limits: As specified in Section 01 6116.
   4. Thickness: 0.125 inch (3.2 mm).
   5. Pattern: Solid color.
   6. Manufacturers:
      a. Armstrong World Industries, Inc; Product Natural Creations: www.armstrong.com.
      b. Mohawk Group; Product Sereno C0004: www.mohawkgroup.com. **BASIS OF DESIGN.**
      c. Substitutions: See Section 01 6000 - Product Requirements.
   7. Materials:
      a. **BASIS OF DESIGN**:
         1) LVT 1: 985 Iguazu.
      b. Alternate to Basis of Design:
         1) LVT 1-ALT: Mystic/ TP715 Silk Scarf Black Silver.

2.3 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
   1. Height: 4 inch (100 mm).
   2. Thickness: 0.125 inch (3.2 mm) thick.
   3. Finish: Matte.
   4. Length: Roll. Continuous Coil.
   5. Color: Solid color.
   6. Manufacturers:
      a. Johnsonite, a Tarkett Company: www.johnsonite.com. **BASIS OF DESIGN.**
      b. Roppe Corp: www.roppe.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   7. Materials:
      a. **BASIS OF DESIGN:** These selections are to be used together as indicated on the drawings. No alterations or substitutions. No exceptions without approval of the Architect.
         1) RB 1: 63 Burnt Umber.
         2) RB 2: 48 Grey.
      b. Alternate to Basis of Design: These selections are to be used together as indicated on the drawings. No alterations or substitutions. No exceptions without the approval of the Architect.
         1) RB 1- ALT: 193 Black Brown.
         2) RB 2- ALT: 148 Steel Grey.

2.4 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions from the flooring manufacture if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

3.5 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

3.7 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Exposed surfaces of steel lintels and ledge angles.
   4. Interior walls and bottom of swimming pools and fountains.
   5. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically so indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Glass.
   11. Concrete masonry in utility, mechanical, and electrical spaces.
   12. Acoustical materials, unless specifically so indicated.
   13. Concealed pipes, ducts, and conduits.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 5000 - Metal Fabrications: Shop-primed items.

C. Section 05 5100 - Metal Stairs: Shop-primed items.

D. Section 09 9600 - High-Performance Coatings.

E. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Painted identification.

F. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Color coding scheme for items to be painted under this section.

G. Section 22 0553 - Identification for Plumbing Piping and Equipment: Color coding scheme for items to be painted under this section.

H. Section 23 0553 - Identification for HVAC Piping and Equipment: Painted identification.

I. Section 23 0553 - Identification for HVAC Piping and Equipment: Color coding scheme for items to be painted under this section.

J. Section 26 0553 - Identification for Electrical Systems: Painted identification.

K. Section 26 0553 - Identification for Electrical Systems: Color coding scheme for items to be painted under this section.

L. Section 32 1723.13 - Painted Pavement Markings: Painted pavement markings.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.6 SUBMITTALS

A. See Section 01 3000 - 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. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

C. Samples: Submit two paper chip samples, 12 x 12 inch (304.8 x 304.8 mm) in size illustrating range of colors available for each surface finishing product scheduled.

D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and coated surfaces, and color samples of each color and finish used.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.8 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide door and frame assembly illustrating paint coating color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.9 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 (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide all 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.

C. Paints:
   1. Benjamin Moore & Co: www.benjaminmoore.com.
   2. PPG Architectural Finishes, Inc: www.ppgaf.com.
   3. Sherwin-Williams Company: www.sherwin-williams.com.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 6000 - Product Requirements.
   1. Product selections are based on physical properties and design qualities integral to the design of the project. All substitutions must meet the criteria stipulated in this section, **and the substitution must meet the aesthetic qualities and intent of the design to the satisfaction of the Architect. The Architect's decision regarding this matter is final**.

2.2 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings 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 coating material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

D. Flammability: Comply with applicable code for surface burning characteristics.

E. Colors: As indicated on drawings
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.3 PAINT SYSTEMS - EXTERIOR

A. Paint GE-OP-3A - Gypsum Board and Plaster, Opaque, Alkyd, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Flat: Two coats of alkyd enamel.

B. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.

2. Gloss: Two coats of alkyd enamel.

2.4 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry, brick, plaster, uncoated steel, shop primed steel, and galvanized steel.
   1. Two top coats and one coat primer.
   2. Top Coat(s): MPI Institutional Low Odor/VOC Interior Latex; MPI #143-148.
   3. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
   4. Eggshell: MPI gloss level 3; use this sheen at all locations.
   5. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
   6. Top Coat Product(s):
   7. Primer(s): As recommended by manufacturer of top coats.

B. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
   1. One coat of block filler.
   2. Semi-gloss: Two coats of latex enamel.

C. Paint MI-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Gloss: Two coats of alkyd enamel.

D. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. One coat of latex primer.
   2. Gloss: Two coats of latex enamel.

E. Paint GI-OP-3A - Gypsum Board/Plaster, Alkyd, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Semi-gloss: Two coats of alkyd enamel.

F. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Flat: Two coats of latex enamel.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

K. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

L. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

M. Shop-Primed Steel Surfaces to be Finish Painted: 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.

N. Interior 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.

O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 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 instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.7 SCHEDULE - PAINT SYSTEMS

A. Concrete, Concrete Block, Brick Masonry: Finish all surfaces exposed to view.
   1. Interior: CI-OP-3L, semi-gloss.

B. Gypsum Board: Finish all surfaces exposed to view.
   1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
   2. Interior Walls: GI-OP-3A, semi-gloss.

C. Plaster: Finish all surfaces exposed to view.
   1. Exterior Soffits: GE-OP-3A, flat.

D. Steel Doors and Frames: Finish all surfaces exposed to view; MI-OP-3A, gloss.

E. Steel Fabrications: Finish all surfaces exposed to view, except structural steel and those items to receive high performance coating. See Section 09 9600 High Performance Coatings.
   1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.
   2. Interior: MI-OP-3L, gloss.

F. Galvanized Steel: Finish all surfaces exposed to view.
   1. Interior: See Section 09 9600 High Performance Coatings.

G. Shop-Primed Metal Items: Finish all surfaces exposed to view.
   1. Finish the following items:
      a. Elevator pit ladders.
      b. Exposed surfaces of steel stairs and railings.
   2. Exterior: See Section 09 9600 High Performance Coatings.
   3. Interior: See Section 09 9600 High Performance Coatings.

END OF SECTION

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SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. High performance coatings.

B. Special preparation of surfaces.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9000 - Painting and Coating.

1.4 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

B. SSPC-SP 3 - Power Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

C. SSPC-Paint 16 - Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint; Society for Protective Coatings; 1982 (Ed. 2006).

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.

2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.6 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 three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.7 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

D. Restrict traffic from area where coating is being applied or is curing.

1.8 WARRANTY

A. See Section 01 7800 - 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 and degradation of chemical resistance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. High-Performance Coatings:
   1. PPG Architectural Finishes, Inc: www.ppgaf.com.
   2. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
   3. Tnemec Company, Inc: www.tnemec.com. **BASIS OF DESIGN.**
   4. Substitutions: Section 01 6000 - Product Requirements.

2.2 HIGH-PERFORMANCE COATINGS

2.3 MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Lead content: Not greater than 0.06 percent by weight of total nonvolatile content.
   2. Chromium content, as hexavalent chromium, zinc chromate, or strontium chromate: None.
   3. Maximum volatile organic compound (VOC) content: As required by applicable regulations.
   4. Colors: Selected from manufacturer's standard colors.

B. Urethane Coating: Two coats, two-part, aliphatic moisture-curing polyurethane, gloss finish.

C. High-Build Urethane Coating: Two coats, two-part, aliphatic moisture-curing polyurethane, gloss finish.
   1. Product characteristics:
      a. Percentage of solids by volume: 60, minimum.
      b. Dry film thickness, per coat: 2.0 to 3.0 mils, minimum.
      c. Comply with the performance requirements specified above for moderate exposure.
   2. Product: Series 1070/Fluoronar manufactured by Tnemec Inc..
   3. Primer for ferrous metal: as recommended by manufacturer.
   4. Primer for non-ferrous metal: as recommended by manufacturer.

D. Coal Tar Epoxy Coating: Two coats high-build, two-part.
   1. Product characteristics:
      a. Percentage of solids by volume: 75, minimum.
      b. Dry film thickness, per coat: 8.0 to 10.0 mils, minimum.
      c. Comply with the performance requirements specified above for moderate corrosive exposure.
   2. Product: Series 46H-413 manufactured by Tenemec.
   3. Primer for ferrous metal for atmospheric service: as recommended by manufacturer.

E. Primers: As recommended by coating manufacturer for specific substrate, unless otherwise specified.

F. Shellac: Pure, white type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. 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.

C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.

3.2 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

E. Ferrous Metal:
   1. Solvent clean.
   2. Remove loose rust, loose mill scale, and other foreign substances using power tools according to SSPC-SP 3.

F. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.3 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.4 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. 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.

3.5 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.

3.6 PROTECTION

A. Protect finished work from damage.

3.7 SCHEDULE

A. Colors: As indicated on Finish Schedule.

B. Exterior Ferrous Metal Railings and Handrails, Fences, Gates: Urethane, gloss, shop-applied after cleaning to bare metal, all surfaces coated including surfaces to be concealed or embedded in concrete.

C. Exterior and Interior exposed Structural Steel, rigid frames, structural columns, beams, supports, girts, purlins and associated structural system components: Urethane, gloss. Coat all surfaces (exposed and concealed).

D. Steel Lintels to be embedded in Concrete and Masonry: Coal tar epoxy coating, shop-applied, all surfaces.

END OF SECTION

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SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Plaques.

B. Dimensional characters.

C. Panel signs.

1.3 RELATED REQUIREMENTS

A. Division 01 "Product Substitution Procedures".

B. Division 01 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.

C. Division 23 "Identification for Plumbing and Equipment" for labels, tags, and nameplates for mechanical equipment.

D. Division 26 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.4 REFERENCE STANDARDS

A. Americans with Disabilities Act (ADA) - Standards for Accessible Design; 2010.

B. AAMA 611 (American Architectural Manufacturers Association) - Voluntary Specification for Anodized Architectural Aluminum; 2014.

C. AAMA 2603 (American Architectural Manufacturers Association) - Voluntary Specification for Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; latest edition.

D. ICC/ANSI A117.1 - Standard for Accessible and Usable Buildings and Facilities; 2009.

E. ASTM B26 (ASTM B26M) - Standard Specification for Aluminum-Alloy Sand Castings; 2014e1.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. NAAMM - Metal Finishes Manual for Architectural and Metal Products; current edition.

1.5 SUBMITTALS

A. General: The following submittal package shall be submitted as a complete package, including the following listed below. Individual submittals will be returned unaccepted until the complete package is submitted.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, type styles, graphic elements, including tactile characters and Braille, and layout for each sign.

D. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
   1. Aluminum.
   2. Acrylic sheet.
   3. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.

E. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Plaque Casting: 6 inches (150 mm) square including border.
   2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
   3. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).
   4. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
   5. Panel Signs: Not less than 12 inches (305 mm) square including border.

F. Sign Schedule: Use same designations indicated on Drawings.

G. Qualification Data: For the Installer and fabricator.

H. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metal and polymer finishes beyond normal weathering.
      b. Deterioration of embedded graphic image colors and sign lamination.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

2.2 PLAQUES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A.R.K. Ramos (Basis of Design)
   2. Gemini Incorporated

B. Cast Plaques: Provide castings free of pits, scale, sand holes, and other defects, as follows:
   1. Plaque Type **(BP1)**:
      a. Plaque Size: 15 inches and 24 inches.
      b. Plaque Material: Aluminum.
      c. Background Texture: Architect to select from manufacturer's standard textures.
      d. Border Style: Architect to select from manufacturer's standard textures.
      e. Mounting: Concealed studs, non-corroding for substrates encountered.
      f. Thickness: 0.250 inch (6.35 mm) thick.
      g. Character Size: To be selected by Architect from manufacturer's full range of fonts.
      h. Character Finish/Color: Architect to select from manufacturer's standard colors.
      i. Text/Message:
         1) Graphics: Image of the seal of the State of Louisiana.
         2) Text:
            (a) Name of the Project (per Capital Outlay).
            (b) Year facility was completed.
            (c) Name of the current Governor.
            (d) Name of the Architect.
            (e) Name of the Contractor.
            (f) The words: "Project funded by the tax payers of Louisiana".
      j. Location: As indicated on the drawings.
      k. Quantity: One.
   2. Plaque Type **(BP2)**:
      a. Plaque Size: 6 feet (1.8288 m) diameter.
      b. Plaque Material: Aluminum.
      c. Background Texture: Architect to select from manufacturer's standard textures.
      d. Border Style: Architect to select from manufacturer's standard textures.
      e. Mounting: Concealed studs, non-corroding for substrates encountered.
      f. Thickness: 0.250 inch (6.35 mm) thick.
      g. Character Size: To be selected by Architect from manufacturer's full range of fonts.
      h. Character Finish/Color: Architect to select from manufacturer's standard colors.
      i. Text/Message:
         1) Graphics: Image of the seal of the State of Louisiana.
         2) Text:
            (a) Name of the Project (per Capital Outlay).
            (b) Year facility was completed.
            (c) Name of the current Governor.
            (d) Name of the Architect.
            (e) Name of the Contractor.
            (f) The words: "Project funded by the tax payers of Louisiana".
      j. Location: As indicated on the drawings.
      k. Quantity: One.

2.3 DIMENSIONAL CHARACTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASI-Modulex, Inc. (Basis of Design)
   2. A.R.K. Ramos.
   3. Gemini Incorporated.

B. Fabricated Metal Letters: Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with the following requirements:
   1. Aluminum Sheet: Not less than 0.090 inch (2.29 mm) thick.
      a. Finish: Brushed Aluminum.
      b. Color: Clear Anodized.
      c. Font: To match campus standards, as selected by Architect from manufacturer's full range.
      d. Mounting: Projected with concealed non-corroding studs for substrates encountered.
   2. Provide manufacturer's hardware for projection mounting of channel characters at 1/2 inch (12.7 mm) distance from wall surface indicated on drawings.

C. Dimensional Character Sign Schedule:
   1. Sign Type (ES1):
      a. Character Size: 12 inch (304.8 mm) high.
      b. Text/Message: As indicated on drawings.
      c. Location: As indicated on drawings.
   2. Sign Type (ES2):
      a. Character Size: 9 inch (228.6 mm) high.
      b. Text/Message: As indicated on drawings.
      c. Location: As indicated on drawings.

2.4 PANEL SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASI-Modulex, Inc. (Basis of Design)
      a. Venus Series.
   2. 2/90 Sign Systems.
      a. Modular Essentials.

B. Panel Sign Frames:
   1. Extruded-Aluminum Frames: Mitered.
      a. Color: Clear Anodized
      b. Profile: Square.
      c. Corner Condition: Square.
      d. Mounting: As indicated.
         1) Wall mounted with two-face tape.
         2) Wall mounted with Hilti-Toggler for sizes 12 by 12 inch (304.8 by 304.8 mm) or larger.

C. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.
   1. Furnish insert material and software for creating text and symbols for PC-Windows for Owner production of paper inserts.
   2. Furnish insert material cut-to-size for changeable message insert.

D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
   1. Panel Material: Photopolymer.
   2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

E. Schedule/Locations: As indicated on the drawings.

2.5 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors for all sizes greater than 12 by 12 inches (304.8 by 304.8 mm). Furnish inserts, as required, to be set into concrete or masonry work.

2.6 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated. Comply with requirements indicated for material, thicknesses, finishes, colors, designs, shapes, sizes and details of construction.
   1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
   2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
   3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
   4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
   5. Form panels to required size and shape.
   6. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.
   1. Location: Panel Signs as indicated on the drawings.

B. At Exterior Plaques.
   1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
      a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated on drawings and as scheduled, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls (or non-active door leaf). Locate to allow approach

within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
   2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
   3. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
   4. Signs larger than 12 by 12 inch (304.8 by 304.8 mm) are to be mounted using Hilti - Togglers as recommended by manufacturer for size and weight of sign.

C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
   1. Projected Mounting: Mount characters at projection distance from wall surface indicated. Install a minimum of 1/2 inch (12.7 mm) off the wall, unless noted otherwise.

D. Cast-Metal Plaques: Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
   1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

3.3 CLEANING AND PROTECTION

A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible from a distance of 5 feet.

B. Remove temporary coverings and protection to adjacent work areas.

C. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

SECTION 10 2829
UNDERSINK LAVATORY PIPE INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ADA-compliant, under-sink protective lavatory pipe insulation for “accessible” lavatories to prevent burns.

B. Related Sections include:
   1. Division 01 "Product Substitution Procedures".
   2. Division 23 Mechanical Sections: Lavatories, piping, and pipe insulation (for applications other than accessible lavatory exposed pipes).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and application recommendations for type of insulation product proposed.

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials, which are self-extinguishing within 5 seconds with average 10 mm. extent of burning per the ASTM D 635 test method.

B. Single-Source Responsibility: Obtain lavatory pipe insulation from a single source to provide products of consistent appearance and physical properties.

C. ADA Compliance: Pipe insulation shall comply with applicable requirements of the American Disabilities Act.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect insulation from physical damage and deterioration. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 PRODUCTS

2.1 UNDERSINK LAVATORY PIPE INSULATION

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. "Handi Lav-Guard" insulation products of Truebro, Inc., Ellington, Connecticut; (203) 875-2868.
2. "Pro-Extreme" molded insulated PVC covers by Plumberex Specialty Products, Inc., Palm Springs, California; (800) 475-8269.

B. Description: Universal assemblies for installation on standard plumbing piping assemblies, consisting of molded closed cell vinyl with the following characteristics:
1. Nominal Wall Thickness: 3/16 inch.
2. Hardness: 55 to 65 Shore A durometer.
3. Ultra Violet Protection: Integral barrier.
4. Color: Manufacturer's standard paintable white or gray integral color, as selected by the Architect.
5. Thermal Conductivity: k = 1.17.

C. Configuration: Provide manufacturer's standard insulation kit for the following components; coordinate with Division 15 for piping configuration:
1. P-trap assembly, cast brass or tubular, 1-1/4-inch or 1-1/2-inch diameter.
2. 1-1/4-inch or 1-1/2-inch diameter tailpiece.
3. Hot water angle valve assembly, 3/8-inch or 1/2-inch size.
4. Cold water angle valve assembly, 3/8-inch or 1/2-inch size.
5. Offset wheelchair strainer assembly (McGuire).

D. Fasteners: Provide manufacturer-furnished or -recommended fasteners for securing the insulating assemblies in position.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examining: Examine substrates and conditions for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until piping is complete and tested, pipe escutcheons are secured in position, other finishing work in space is complete and unsatisfactory conditions have been corrected.

B. Preparing: Clean substrates of substances harmful to insulations including removal of projections and foreign materials.

3.2 INSTALLATION

A. General: Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Application: Extend insulation full thickness as indicated to envelop entire piping assembly to be insulated. Cut and fit as necessary to fully cover as-installed piping. Secure installed insulation as recommended by the insulation manufacturer.

3.3 COMPLETION

A. Insulation: Completed application shall form a continuous insulating barrier without gaps. Each insulating component shall be secured against dislodgement incidental to use of the lavatory by wheelchair occupants or by cleaning personnel.

B. Protection: Protect installed insulation until acceptance from damage. Remove and replace with new material insulation components, which are damaged or defective.

END OF SECTION

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SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.3 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 2116 - Gypsum Board Assemblies: Roughed-in wall openings.

C. Section 09 900 - Painting and Coating.

1.4 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, and location.

C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
   1. Fire Extinguishers: Include rating and classification.
   2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

D. Samples: Submit samples for verification purposes of each type of metal finish required, prepared on metal samples of same thickness and alloy indicated for final

unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

E. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.6 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, “Standard for Portable Fire Extinguishers”.

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Single-Source Responsibility: Obtain fire extinguishers and cabinets from one source from a single manufacturer.

D. ADAAG Compliance: Comply with ADAAG on maximum cabinet projection of 4" in corridors where necessary.

1.7 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:
   1. **BASIS OF DESIGN**:
      a. Larsen: www.larsensmfg.com.
   2. Alternate Manufacturer:
      a. J.L Industries, Inc: www.jlindustries.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. **BASIS OF DESIGN**:
      a. Larsen's Manufacturing Co: www.larsensmfg.com.
   2. Alternate Manufacturer:
      a. JL Industries, Inc: www.jlindustries.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL for the purpose specified and indicated.

B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Manufacturers:
      a. Larsen; MP Series, Model MP5-A.
   2. Characteristics:
      a. Stored Pressure Operated: Deep Drawn.
      b. Class: 3A;40B:C.
      c. Size/Capacity: 5 pound (2.27 kg).
      d. Finish: Baked polyester powder coat, color as selected by Architect from manufacturer's full range.

2.3 FIRE EXTINGUISHER CABINETS

A. Manufacturers:
   1. Larsen's Manufacturing Co; Architectural Series, Model No. AL-2409-R3.

B. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

C. Cabinet Configuration: Semi-recessed type.
   1. Inside Box nominal dimensions of 9-1/2 inch (241 mm) wide x 24 inch (610 mm) high x 5 inch (127 mm) deep.
   2. Outside Trim Dimensions: 27-1/2 high by 13 wide inch (699 high by 330 wide mm)
   3. Rough Opening Dimensions: 25 high by 10-1/2 wide by 3 deep inch (635 high by 267 wide by 76 deep mm).
   4. Trim: Returned to wall surface, with 1-1/2 inch (38 mm) projection, 1-1/2 inch (38 mm) wide face. Square edge. All corners mitered.
   5. Tub: Manufacturer's standard cold-rolled heavy gage steel box, 3/4-inch flange, white baked enamel interior finish.

D. Door Material: Aluminum.

E. Door Type: Solid.

F. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

G. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

H. Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected by Architect from manufacturer's full range.

J. Finish of Cabinet Interior: White enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.
   1. FEB-1: Provide brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated. Subject to compliance with requirements, provide one of the following:
      a. LARSEN; Standard Bracket- 1521.
      b. Finish: Manufacturer's standard baked enamel.
      c. Location of Use: Provide brackets for each extinguisher not located in an extinguisher cabinet.
      d. Identify extinguisher locations with red lettering "FIRE EXTINGUISHER" applied to mounting surface. Letter size, style, and location as selected by the Architect.

B. Cabinet Signage: "FIRE EXTINGUISHER".
   1. Lettering in color as selected by Architect from manufacturer's full range.
   2. Lettering to be manufacturer's standard "Type A" die-cut lettering as selected by Architect from manufacturer's full range of styles, fonts, colors and orientation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets and on wall brackets.

E. Bracket-Mounted Extinguishers: Where exact location of bracket mounted fire extinguishers is not indicated, locate as directed by Architect.

3.3 COMPLETION

A. Extinguishers: Keep extinguishers in locked storage until just prior to inspection for acceptance; obtain signed receipt from Owner's representative and place extinguishers in designated locations, unless instructed to maintain in storage.
   1. Verify that certification tags are attached to each extinguisher.
   2. Replace or recharge, and recertify, extinguishers that were discharged during construction period, either accidentally or in an emergency.

B. Cabinets: All cabinets shall be properly located and rigidly secured, plumb and level. Clean exposed surfaces inside and outside. Remove and replace items, which are damaged and defective and which cannot be acceptably repaired.

C. Other Work: Clean and repair other surfaces damaged, soiled or marred by work of this Section; remove and replace items which cannot be acceptably cleaned or repaired.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 11 3100
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 2717 - Equipment Wiring: Electrical connections for appliances.

1.3 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

B. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.6 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.1 APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Manufacturers:

1. Kenmore
2. General Electric
3. Prior approved equal per section 01 6300.

2.2 KITCHEN APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Range Hood:

1. Model: Kenmore 51640590 **(Basis of Design)**
2. Size: 30” Wide
3. Finish: Stainless Steel
4. Features: Ducted to outside.
5. Voltage: 110V

C. Residential Fire Suppression System:

1. Model: Guardian G300-A
2. Type: Wet Chemical Extinguishing Unit
3. Features: Automatic Electric Shutoff, Interconnect Cable, Extinguisher Enclosure and Dual Heads. Install unit in cabinet above Hood System.

D. Electric Range:

1. Model: Kenmore 42513 Drop in Range **(Basis of Design)**
2. Size: 30” Wide
3. Finish: Stainless Steel.
4. Capacity 4.2 (cu. Ft.)
5. Burners: 5
6. ADA Compliant: Yes

E. Refrigerator:
   1. Model: Kenmore Elite 51773 **(Basis of Design)**
   2. Type: Side by Side French Doors.
   3. Finish: Stainless Steel.
   4. Capacity: Refrigerator 17 (cu. Ft.), Freezer 10.7 (cu. Ft.)
   5. Features: Ice and Water Dispenser, Frost Free Automatic and Built-in Water Filter.
F. Dishwasher:
   1. Model: Kenmore 12333 **(Basis of Design)**
   2. Finish: Stainless Steel
   3. Features: Quiet Package, Multiple Door Positions and Self Cleaning Filter.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.3 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

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SECTION 12 3530
RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes **kitchen and entry** cabinets.

B. Related Requirements:

1. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

C. Semi-exposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors, interiors and sides of drawers, and bottoms of wall cabinets.

D. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, ends of cabinets installed directly against and completely concealed by walls or other cabinets, and tops of wall cabinets and utility cabinets.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cabinets.
2. Cabinet hardware.

B. Shop Drawings: Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, and hardware.

C. Samples: For cabinet finishes.

D. Samples for Initial Selection: For cabinet finishes.

E. Samples for Verification: 8-by-10-inch (200-by-250-mm) Samples for each type of finish and the following:

1. Exposed hardware, for each type of item.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For casework.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

1.7 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Merillat: Classic Fusion (Basis of Design)
1. Door Panel Style: Solid Slab Style.
2. Overlay: Full.
3. Door Center Panel: Veneer.

4. Wall Cabinet Style: Square.
5. Door Frame: Solid Wood
6. Box Construction: Framed
7. Shelf Thickness: ¾ Inch.
8. Door Shape: Slab
9.

B. Other Acceptable Manufacturers:
1. KraftMaid: www.kraftmaid.com
2. Oquality Cabinets: www.qualitycabinets.com
3. Substitutions: See Section 01 6300 - Product Substitution Procedures.

C. Quality Standard: Provide cabinets that comply with KCMA A161.1.

2.2 CABINETS

A. Quality Standard: Provide cabinets that comply with KCMA A161.1.

1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semi-exposed location of each unit and showing compliance with the above standard.

B. Face Style: Flush overlay; door and drawer faces cover cabinet fronts with only enough space between faces for operating clearance.

C. Face Style: Reveal overlay; door and drawer faces partially cover cabinet fronts.

D. Face Style: Lipped overlay; door and drawer faces are rabbeted and partially inset within cabinet fronts with the lip of the rabbet overlapping cabinet-body members or face frames.

E. Face Style: Flush inset; door and drawer faces are set within cabinet fronts, flush with faces.

F. Cabinet Style: Face frame

G. Door and Drawer Fronts: 1/2-inch- (12.7-mm-) thick, veneer-faced plywood.

H. Face Frames: 3/4-by-1-5/8-inch (19-by-41-mm) solid wood with glued mortise and tenon or doweled joints.

I. Face Frames: 5/8-inch- (16-mm-) thick particleboard with plastic laminate on exposed and semi-exposed surfaces.

J. Face Frames: 5/8-inch- (16-mm-) thick, thermoset decorative panel material.

K. Face Frames: 1/2-inch- (12.7-mm-) thick, thermoformed-vinyl-faced panels with vinyl overlay on exposed and semi-exposed surfaces.

L. Exposed Cabinet End Finish: Wood veneer.

M. Cabinet End Construction: 1/2-inch- (12.7-mm-) thick plywood.

N. Cabinet Tops and Bottoms: 1/2-inch- (12.7-mm-) thick plywood, fully supported by and secured in rabbets in end panels**,** front frame**,** and back rail.

O. Back, Top, and Bottom Rails: 3/4-by-2-1/2-inch (19-by-63-mm) solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.

P. Wall-Hung-Unit Back Panels: 3/16-inch- (4.8-mm-) thick plywood fastened to rear edge of end panels and to top and bottom rails.

Q. Base-Unit Back Panels: 3/16-inch- (4.8-mm-) thick plywood fastened to rear edge of end panels and to top and bottom rails.

R. Front Frame Drawer Rails: 3/4-by-1-1/4-inch (19-by-32-mm) solid wood mortised and fastened into face frame.

S. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.
2. Subfronts, Backs, and Sides: 1/2-inch- (12.7-mm-) thick solid wood.
3. Bottoms: 3/16-inch- (4.8-mm-) thick plywood.

T. Shelves: 1/2-inch- (12.7-mm-) thick plywood.

U. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.

V. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.

2.3 CABINET MATERIALS

A. General:

B. Exposed Materials:

1. Exposed Wood Species: Birch.

a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.

b. Staining and Finish: As selected by Architect from manufacturer's full range.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.

a. Edge band exposed edges with a minimum of 1/8-inch- (3-mm-) thick, solid-wood edging of same species as face veneer.

C. Semi-exposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces or stained to be compatible with exposed surfaces.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.4 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Wire pulls.

C. Hinges: Concealed butt hinges**,** soft close.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install cabinets level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

D. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Countertops for architectural cabinetwork.

B. Countertops for manufactured casework.

C. Wall-hung counters and vanity tops.

1.3 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.4 REFERENCE STANDARDS

A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

C. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

E. ISFA-2 - Classification and Standards for Solid Surfacing Material; International Solid Surface Fabricators Association; 2001 (2013).

F. MIA (DSDM) - Dimensional Stone Design Manual; VII, 2007.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

H. PS 1 - Structural Plywood; 2009.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Installation Instructions: Manufacturer's installation instructions and recommendations.

H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Quality Certification: Provide AWI Quality Certification Program (QCP) inspection report and quality certification of completed work.
   1. Provide labels or certificates indicating that the work complies with requirements of AWS Grade or Grades specified.
   2. Prior to delivery to the site provide shop drawings with certification labels.
   3. Provide labels on each product when required by certification program.
   4. Upon completion of installation provide certificate certifying that the installation and products meet the specified requirements.
   5. Arrange and pay for inspections required for certification.
   6. Replace, repair, or rework all work for which certification is refused.

C. Installer Qualifications: Fabricator.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOP ASSEMBLIES

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS).

B. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.
   1. Laminate Sheet, Unless Otherwise Indicated: NEMA LD 3, Grade HGS, 0.048 inch (HGS, 1.2 mm) nominal thickness.
      a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
      b. NSF approved for food contact.
      c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
      d. Laminate Core Color: Same as decorative surface.
      e. Finish: Matte or suede, gloss rating of 5 to 20.
      f. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
      g. Manufacturers:
         1) Panolam Industries International, Inc\Nevamar : www.nevamar.com.
            (a) Color: MR6002T As selected by Architect
         2) Wilsonart International, Inc: www.wilsonart.com. **BASIS OF DESIGN**.
            (a) Color: As indicated on drawings.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch (32 mm) thick; covered with matching laminate.
   3. Back and End Splashes: Same material, same construction.
   4. Fabricate in accordance with AWI/AWMAC/WI (AWS) standards, Section 11 - Premium Grade.

2.2 ACCESSORY MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
   2. Provide wood harvested within a 500 mile (805 km) radius of the project site.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

D. Joint Sealant: Mildew-resistant silicone sealant, white.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).

C. Attach epoxy resin countertops using compatible adhesive.

D. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 12 4816

ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes recessed foot grilles and frames.

B. Related Requirements: The following sections contain requirements related to this section:
1. Division 01 "Product Substitution Procedures".
2. Division 03 “Cast-In-Place Concrete” for slab depression grouting and filling for recessed foot grilles and frames.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide foot grilles and frames capable of withstanding the following loads and stresses:
1. Uniform floor load of 300 lbf/sq. ft. (14.36 kN/sq. m).
2. Wheel load of 350 lb (159 kg) per wheel.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for foot grilles and frames.

B. Shop drawings in sufficient detail showing layout of grid and frame specified including details indicated construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.
1. Items penetrating floor mats and frames.
2. Divisions between grille sections.
3. Perimeter floor moldings.

C. Samples: Submit an assembled section of floor grid and frame members with selected tread insert showing each type of color for exposed floor grid, frame and accessories required.
1. Foot Grille: 12-inch- (300-mm-) square assembled sections.
2. Frame Members: 12-inch- (300-mm-) long Sample of each type and color.

D. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor grids at Project Closeout.

1.5 QUALITY ASSURANCE

A. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

B. Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/m².

C. Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for accessible routes.

D. Single Source Responsibility: Obtain floor grids and frames from one source of a single manufacturer.

E. Utilize superior structural aluminum alloys 6105-T5 for rail components.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.7 PROJECT CONDITIONS

A. Field measurements: check actual openings for grids by accurate field measurements before fabrication. Indicate actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

B. Coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat. Defer frame installation until building enclosure is complete and related interior finish work is in progress.
1. Coordinate size and location of recesses in concrete to receive foot grilles and frames.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace those grille and frame components that fail in material or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR GRILLS (WO1)

A. Manufacturers: Manufacturers: Subject to compliance with requirements, provide products by one of the following for a complete system:
1. Balco Inc. **(Basis of Design).**
   a. Series: Mill Finish Aluminum Floor Grid w/ Abrasive Treads.
   b. Model No.: FG-1 1/2A.
2. Pawling Corporation; Architectural Products Division.
   a. Series: Pro-Tek Entrance Grating.
   b. Style: Drain-Well.
   c. Model No.: RG-400.

2.2 MATERIALS

A. Aluminum – Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52 as standard with manufacturer. Coat surface of frame in contact with cementitious materials with manufacturer's standard protective coating.

2.3 FOOT GRILLES

A. General: Provide manufacturer's standard foot-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.

B. Aluminum Foot Grilles: Provide manufacturer's standard foot grilles with extruded members, top-surfaced tread rails, and as follows:
1. Tread Rails: Extruded- aluminum tread rails with extruded-aluminum frame.
2. Tread Rail Spacing: 1-1/2 inches (38 mm) o.c. with 1/8- to 3/16-inch- (3- to 4.8-mm wide openings between treads.
3. Aluminum Finish: Mill.
   a. Colors: Clear natural aluminum.
4. Top Surface: Abrasive particles bonded to or imbedded in vinyl insert.
   a. Colors: As selected by Architect from manufacturer's full range.

C. Lockdown: Manufacturer's standard Hidden locking system.

2.4 FRAMES

A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

2.5 SUPPORT SYSTEM

A. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.

2.6 FABRICATION

A. Shop fabricate foot grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.

B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of foot grilles and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Manufacturer shall offer assistance and guidance to provide a template of grid assemblies to ensure a proper installation.

3.3 INSTALLATION

A. Install recessed foot grilles and frames to comply with manufacturer's written instructions at locations indicated and with top of foot grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set foot-grille tops at height for most effective cleaning action. Coordinate top of foot-grille surfaces with doors that swing across grilles to provide clearance under door.

3.4 CLEANING

A. It is important to the life cycle of the entrance grille that a maintenance schedule be developed which includes regular vacuuming and extraction that correctly matches the amount of traffic the grille incurs.

3.5 PROTECTION

A. After completing required frame installation and concrete work, provide temporary filler of plywood in recess and cover frames with plywood. Maintain protection until construction traffic has ended and project is near time of substantial completion.

B. Defer installation of floor grilles until time of substantial completion of project.

END OF SECTION

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SECTION 21 0500

COMMON WORKS RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions, (if any) and other General Requirements, apply to the work specified in this section.

B. Other Fire Protection Sections are as follows:

1. Wet Pipe Sprinkler System: Section 21 1000

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for fire protection installations and expands the requirements specified in Division 01. These requirements are: Contractor's Qualifications; Quality Assurance; Reference Codes and Standards; Permits and Inspections; Equipment and Materials; Delivery, Storage, and Handling; Examination of Premises; Submittals; Coordination Drawings; Record Documents; Project Closeout; Warranty; Measurements; Operation Prior to Substantial Completion; Electrical Work; Painting; Protection of Equipment and Work; Rough-ins; Fire Protection Installations; and Cutting and Patching. This Section applies to all Fire Protection Sections.

1.3 DEFINITIONS

A. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

B. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.

C. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

D. Installer: The term "Installer" is defined as the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection,

application and similar required operations. Installers shall be skilled in the work they are to perform.

E. Specialist: The term "Specialist" means an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workmen skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the contract specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

G. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

H. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

I. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

J. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SCOPE

A. The following requirements apply to the work necessary to provide fire protection systems, as specified in the various Division 21 Fire Protection Sections.

1.5 CONTRACTOR'S QUALIFICATIONS

A. An acceptable contractor for the work under this Division shall be a specialist in this field and have the personal experience, training and skill and the organization to provide a practical working system. He shall have experience and licenses, permits, and certificates required under Louisiana Revised Statutes 40:1628, 40:1653, and 40:1657. If required, furnish acceptable evidence of having contracted for and installed not less than three systems of comparable size and type to this one, that have served their owners satisfactorily for not less than three years. The foreman for this Work shall have had experience in installing not less than three such systems and shall be approved before work is begun.

1.6 QUALITY ASSURANCE

A. Meetings

1. Prior to preparing the shop drawings for submittal, organize a meeting between the Architect and Contractor to establish a full understanding of the design intent. The meeting shall include the Architect, Engineer, Contractor, and trades involved in the preparation of the shop drawings.

B. Manufacturers:

1. Trade names, manufacturers and catalog numbers are mentioned herein and on the Drawings solely in order to establish a standard for the type, general design and quality of product required. Other products similar in design, of equal quality and complying with the Drawings and Specifications will be considered after the contract is let only for those items with which the expression "or approved equal" is used. Where two or more manufacturers or materials are named, the Contractor may submit any of those named, provided they conform to the Specification. Identification in the project documents of any product by name, manufacturer or model number does not include either expressed or implied warranty of unqualified product acceptance. All products must be capable of proper installation in the spaces provided, readily maintained and must satisfy other requirements contained in the contract documents.

2. Motors provided under Division 21 Fire Protection Sections shall comply with NFPA 70 and shall be listed by a Nationally Recognized Testing Laboratory as defined in OSHA Regulation 19107.

1.7 REFERENCE CODES AND STANDARDS

A. Requirements set forth in reference codes and standards are minimum for equipment, material and work. In instances where capacities, size, etc., of equipment, devices or materials listed in the Contract Documents exceed these minimums, listed or shown capacities, etc. shall prevail.

B. Comply with applicable laws, ordinances, codes and rules, with latest revisions, of the following governing agencies:

1. Office of the State Fire Marshal
2. International Building Code, 2009 Edition

C. Industry standards and specifications issued by the following organizations shall apply to materials and workmanship:

1. NFPA: National Fire Protection Association
2. ETL: Engineering Testing Laboratory
3. NEMA: National Electrical Manufacturers' Association
4. FM: Factory Mutual

5. UL: Underwriters' Laboratories, Inc.

D. Local laws and codes take precedence over industry standards.

1.8 PERMITS AND INSPECTIONS

A. Permits and Fees: Obtain and pay for all permits and all other fees required by regulatory agencies. Pay for all inspections in connection with the work required under local codes.

B. Certificates of Inspection: Upon completion of the work, furnish certificates of inspection from all inspection or regulatory agencies having jurisdiction over work of Division 21 Fire Protection Sections.

1.9 EQUIPMENT AND MATERIALS

A. Manufacturer’s Nameplate: Provide a factory applied nameplate in a prominent location showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. Do not conceal, insulate, or paint the nameplate.

B. Approving Agency (UL, FM, etc.) Label: Securely attach label in full view. Do not conceal, insulate, or paint the label.

C. Equipment and Material Limitations: Provide the latest design of standard products of manufacturers regularly engaged in the production of such equipment.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment and materials to the site and store in original containers, suitably sheltered from physical damage and the elements, but readily accessible for inspection. Equipment damaged in shipment will not be acceptable.

1.11 EXAMINATION OF PREMISES

A. Visit the site of the proposed work before bidding. Inspect the site and become familiar with the difficulties and restrictions attending the execution of the contract.

B. No additional compensation will be allowed for failure to be informed of site conditions.

1.12 SUBMITTALS

A. General:

1. Submit for review shop drawings, product data and samples. Comply with requirements of Section "Submittal Procedures" and the following. Mark each individual item with pertinent specification section and paragraph number. Submit shop drawings, product data, and hydraulic calculations at one time for a single review unless agreed to otherwise at the meeting held prior to shop drawing submittal. Piecemeal submittals are not acceptable and will be returned unreviewed unless agreed to at the shop drawing submittal meeting.

2. If the submittal deviates from the requirements of the Contract Documents, the deviation shall be identified in writing on the first page of the submittal. Identify where within the Contract Documents the deviation occurs. The deviation shall only be considered acceptable if the identified deviation has been initialed by the Engineer. Any deviation not initialed may be assumed to be rejected. All coordination required due to the deviation, such as space allocation, changes to electrical service, or any other required changes shall be born as Work of Division 21 Fire Protection Sections but accomplished by Installers skilled in the Work being performed. No costs incurred by the approved deviation shall be born by the Owner.

3. Review of shop drawings and submittals does not relieve the Contractor of responsibility for compliance with the specific requirements of the Contract Documents, or for fitting the equipment in the space allotted, with proper space for connection of piping and for servicing or for coordination of the work with work of other trades. Approval of deviations also does not relieve the Contractor of responsibility for compliance with all other aspects of the Contract Documents.

4. Review is for general conformance with the design concept of the project, general compliance with the information given in the project documents, and for compliance with the Rules and Regulations of the Office of the State Fire Marshal. Responsibility for confirming and correlating all quantities and dimensions, selecting fabrication processes and establishing techniques of construction resides with Contractor. Include dimensional data and weights of equipment. Include motor manufacturers' names. Submittals and Drawings will be returned after review indicating whether or not exceptions are taken and the required procedure to be followed thereafter. Revised and acceptable submittals and shop drawings are required before submittal to the Office of the State Fire Marshal. Pen and ink changes to the drawings are not acceptable. Because of the complexity of the review, a minimum of 28 calendar days can be expected to elapse before work will be allowed to commence. The Owner will not be responsible for any delays caused by an incomplete or deficient submittal. The Architect or his consultants shall be sole judge as to whether the submittal is incomplete or deficient.

5. Submission of samples may be required by the Architect, particularly where equipment is visible in finished. Arrange demonstrations of a product's ability to perform as specified if required.

B. Shop Drawings:

1. Submit shop drawings covering equipment rooms, equipment foundations, equipment supports, field-fabricated equipment, pipe work and any other drawings specifically called for in other Division 21 Fire Protection Sections or NFPA Codes 13, 14, and 20 as applicable. Shop drawings shall consist of plans, sections, elevations and details to scale (no smaller than 1/4" per foot), with dimensions clearly showing the installation. Floor plans may be submitted at 1/8" per foot scale if approved in advance. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other Divisions and shall show space allotted for it. Include construction details and materials. Submit shop drawings as required in the individual sections. Shop drawings shall comply with both the Contract Drawings and the requirements of the Office of the State Fire Marshal.

2. The drawings show existing construction components and systems as on record by the Owner. Field verifies location and size of structural members, location of partitions, and existing systems shown. If field measurements differ from the information on the drawings causing a conflict in the Work, promptly consult the Architect for resolution. The Owner shall not be responsible for any delays in construction due to the Contractor failing to field verify information shown on the drawings as existing.

C. Product Data:

1. Submit product data within 45 days after award of the contract and before any equipment or materials are purchased. Product data is defined as manufacturers' printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp "No Exceptions Taken" on submittal is required before ordering equipment unless otherwise noted.

2. Submit items identified in the individual Sections. If product data have not been received within 45 days after award of the Contract, only the manufacturer named shall be allowed e.g. if "Viking or approved equal" is stated in the Contract Documents, after 45 days only the Viking product shall be allowed, or if the scheduled equipment on the drawings indicates "Aurora" for pumps, after 45 days only Aurora products shall be allowed.

3. All items that affect the hydraulic calculations shall be submitted including all existing meters, backflow preventers, and flow switches. Equipment being provided by other trades that impact the hydraulic calculations shall also be submitted with the product data identifying the pressure loss caused by the equipment at the flow rate indicated in the hydraulic calculations. Submittals without this information will be considered incomplete.

4. Submit items identified in Division 21 Fire Protection Sections and as required by NFPA 13.

1.13 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 Sections and the following. Minimum scale of 1/4" = 1'-0" detailing major elements, components, and systems of fire protection equipment and materials in relationship with other building systems, installations, and components. Floor plans may be prepared at a scale of 1/8” per foot if approved in advance. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work.

B. Indicate the proposed locations of piping, equipment, and materials and include vertical measurement from floor to center of piping and to bottom of elevated equipment. Include access panel locations, valves, sleeves, location of supports, etc. Indicate vertical measurement at all changes in direction of piping. Make measurements to the middle of piping. Include clearances for servicing and maintaining equipment; space for equipment disassembly for periodic maintenance; and showing areas for equipment removal. Provide details of connections and supports, exterior wall and foundation penetrations, sizes and locations of concrete housekeeping pads, and indicate space for valve stem movement. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Include location of sleeves in floors, walls, and ceilings. Co-operate with work of other Divisions in the preparation of reflected ceiling plans. Ensure sprinklers are adequately shown on the reflected ceiling plans and that they do not conflict with other ceiling mounted items such as diffusers, grilles, lights, detectors, speakers, etc.

D. Fire protection CAD drawings may be made available to the Contractor for a fee for his use in preparing submittal drawings and coordination drawings. The transmitted CAD files are intended as an aid to the Contractor’s development of shop and coordination drawings. Architectural floor plans and sections will not be provided with the fire protection CAD work provided under this paragraph.

1.14 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in paragraph "Project Record Documents". As a minimum, show piping, sprinklers, valves, alarm switches, tamper switches, access panels, etc. Reference prominent building lines when showing dimensions of equipment, pipe, and access panels. Identify installations different from the original plans due to product substitutions, Contract Modifications, and actual equipment and material installed. Provide new hydraulic calculations to reflect the changes if required by the Architect or the Authority Having Jurisdiction. Show all underground elements giving actual inverts and horizontal locations. Engage the services of a Land Surveyor or Professional Engineer registered in the State of Louisiana to record locations and invert elevations of

underground installations. Complete this survey work prior to the covering of the underground installation.

1.15 PROJECT CLOSEOUT

A. Mark and otherwise correct a set of reproducible drawings to reflect the final location of all work installed under Division 21 Fire Protection Sections to serve as record documents. Locate valves, tamper switches, flow alarm switches and other concealed items requiring adjustment or maintenance. Supplement with additional sketches on tracing paper for clarification, if necessary. Certify in writing that record drawings have been checked and are accurate. Submittal of these documents is a prerequisite for certification of Substantial Completion. Contractor may obtain a set of reproducible drawings from the Architect and shall pay for them.

1.16 WARRANTY

A. Warrant all equipment, materials, and workmanship for a period of one year. Repair or replace promptly defects due to faulty materials, methods of installation or workmanship, with the least inconvenience and without expense to the Owner and at time designated by the Architect within the one-year period. Provide additional specific performance or extended time warranties called for in the individual sections.

B. The warranty period for fire protection work shall commence on the date certified by the architect that the contract is Substantially Complete in accordance with the plans and specifications, or upon beneficial use by the Owner, whichever occurs first. When beneficial use is for only a portion of the work, the warranty shall commence only on that portion of the work.

1.17 MEASUREMENTS

A. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Study carefully the sizes and locations of structural members, wall and partition locations, attic spaces, ceiling furring, chase spaces and room dimensions and take actual measurements on the job. Locate piping, equipment and accessories, with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or piping can not be fitted, the Architect shall be consulted. All equipment, apparatus and materials must fit into the available, designated spaces, with proper clearances for maintenance, service and repair.

B. If sprinkler pipe routing is shown on the drawings, it is shown to indicate design intent unless noted otherwise. An alternate routing may be chosen if it is acceptable

to the Architect and coordinated as a deviation to the Contract Documents. The alternate routing shall only be considered if it is at no cost to the Owner with consideration of all changes made necessary due to the change in routing.

1.18 OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Owner shall have the right to operate systems and equipment prior to Substantial Completion, as soon as tested and operational, provided all safety devices have been installed. Agreement between Owner and Contractor relative to time and hours of operation and responsibility for start up and shutdown is required. Do not permit operation which may damage equipment or cause damage to the building or to the work of other contractors. Air filters must be in place on air conditioning units and strainers must be in place in all piping systems prior to operation.

1.19 ELECTRICAL WORK

A. General: Electrical service shall be as indicated on the Drawings. All power wiring and all circuit breakers, starters, disconnect switches, pilot lights, hand-off-automatic (H-O-A) switches, pushbutton stations, except such items which are provided as part of "packaged" fire protection equipment or specifically noted herein, shall be furnished, set in operating position, and electrically connected as work of Division 26, Electrical. All fire alarm connections shall be made as work of Division 26, Electrical.

B. Differing Characteristics: Should the Contractor desire to use equipment requiring larger motors or electrical characteristics differing from those shown, it is the responsibility of work requirements under Division 21 Fire Protection Sections to inform other affected parties of the proposed changes to permit them to supply proper wiring, disconnects and starters. Additional costs incurred to work of other Divisions caused by such changes shall be borne as Work of Division 21 Fire Protection Sections. Prior to equipment delivery from the manufacturer, coordinate with Work of other Divisions to establish areas of possible change between Division 21 Fire Protection Sections Work and Work of other Divisions.

C. Starters: Motor starters furnished with fire protection equipment required under Division 21 Fire Protection Sections shall conform to the requirements of Division 16. Provide motor overload protection requirements for sizing overload protection device for motor starters furnished under Division 26.

D. Conduit and Wiring: As work of Division 21 Fire Protection Sections, provide all interlock conduit and wiring and control conduit and wiring. Set control elements in position and interconnect. Provide control transformers and additional relays required for interface with the electrical system. Power wiring and conduit for all devices is work of Division 26, unless indicated otherwise.

E. Motors: Unless otherwise specified herein, provide motors of the squirrel-cage, high-efficiency type, constant speed, general-purpose for operation on phase and voltage

shown in the Contract Documents. Motors shall be guaranteed to operate continuously at full load at 10 percent voltage variation above or below specified voltage and with temperature rise not to exceed 40 degrees C in any part. Provide internal thermal overload protection. Protection automatically opens control circuit when winding temperature exceeds the safe value calibrated to the temperature rating of the motor insulation. Motors not exposed to the weather shall have open-type enclosures; motors exposed to the weather shall be of the enclosed type. Provide motors with drip-proof and leak-proof sleeve bearings or pre-lubricated ball bearings. For fractional horsepower motors, provide single phase, capacitor start, capacitor run. Acceptable manufacturers are Louis Allis, Allis Chalmers, Electric Machinery, General Electric, Baldor, or Century.

1.20 PAINTING

A. Complete all painting as Work of Section 099000, except for touch-up of factory finishes on equipment located inside and outside. Obtain matched color coatings from the manufacturer and apply as directed. Prime coating of certain equipment is specified under individual equipment specification. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint in accordance with requirements of Section 099000. The corrective or touch-up paint coating shall meet the same manufacturer's coating warranty given for the equipment, or a minimum of one year after Substantial Completion.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT AND WORK

A. Continuously maintain adequate protection of stored materials and installed work. Tightly cover fixtures and equipment, with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust and moisture. Provide heat to equipment being stored to prevent condensation. Do not store materials and equipment outside, directly on the ground, or in areas where it may be subject to physical injury from vehicular traffic or construction machinery. Do not use piping installed under Division 21 Fire Protection Sections as supports for scaffolds or personnel. Do not deliver flow switches and tamper switches, or other delicate equipment to the job site unless they can be placed in protected areas. At the completion of the work, clean equipment and piping, including hangers and supports to the satisfaction of the Architect.

3.2 FIRE PROTECTION INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of fire protection systems, materials, and equipment with other building components. Verify all dimensions by

field measurements. Arrange for chases, slots, and openings in other building components during progress of construction to allow for fire protection installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence and coordinate installation of large pieces of equipment prior to closing in the building.

B. Coordinate connection of fire protection with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect with a suggested resolution. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building components, where installed exposed. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

D. Install fire protection equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Install access panel or doors where equipment is concealed behind finished surfaces. See Division 8 Section "Access Doors."

E. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope. In general, ductwork shall take precedence over piping. Set system elevations to minimize offsets where systems cross. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

3.3 CUTTING AND PATCHING

A. Engage experienced Installers in cutting and patching this work. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. Protect adjacent installations during all cutting and patching operations.

B. Perform cutting, fitting, and patching for fire protection equipment and material installation. Uncover work to provide for installation of ill-timed work. Remove and replace defective fire protection work and work not conforming to requirements of the Contract Documents. Install equipment and materials in existing structures. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.

C. Upon written instructions from the Architect, uncover and restore work to provide for Architect observation of concealed work covered prior to inspection. Uncovering and restoring work required to be observed by the Architect prior to covering as identified in the Contract Documents will be at no cost to the Owner.

END OF SECTION

SECTION 21 1000

WATER-BASED FIRE-SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary conditions, (if any) and other General Requirements, apply to the work specified in this section.

1.2 WORK INCLUDES, BUT IS NOT LIMITED TO

A. Cutting and Patching

B. Drains to exterior disposal points

C. Escutcheons at finished walls and partitions.

1.3 WORK NOT INCLUDED

A. All electrical wiring of sprinkler system water flow switches, position tamper valve switches, and connections from all components in these systems to building central fire alarm system is work of Division 26. Coordinate all work and materials with work for the fire alarm system specified in Division 26.

1.4 QUALIFICATIONS

A. Be fully qualified to install the systems required. Where sprinklers are required, have a minimum 3 years experience in the regular installation of sprinklers. Understand the procedures for calculating the system hydraulics for sizing and submittal requirements for code and regulatory agencies.

1.5 SHOP DRAWING AND SUBMITTALS

A. Make shop drawings and submittals in accordance with Sections 01300 and 13901. Governing Authorities and regulatory agencies (Industrial Risk Insurers (IRI), Factory Mutual (FM), Property Insurance Association of Louisiana (PIAL)), if required by the Owner, shall review the shop drawings. Provide additional copy of the submittal for review by the regulatory agency if required by the Owner. Once submitted to the Architect, one copy will be provided to the regulatory agency for his review. When returned to the Architect by the regulatory agency, the shop drawings will be then

returned to the Contractor for incorporation of the regulatory agencies comments approved by the Owner. Pay for all reviews as part of this Section.

B. Submittals shall include:

1. Sprinklers
2. Alarm Switches
3. Tamper Switches
4. Hangers
5. Gauges
6. Drains
7. Accessories
8. Water Meter
9. Valves
10. Piping Materials
11. Fire Department Connections
12. Pressure Gauges
13. Hydraulic Calculations
14. Backflow Preventer

C. Submit sample of valve tag required under Part 3 below. Submit sprinkler system diagram charting valves with designated valve number, function and location. Diagram shall be the same as one mounted and hung under Part 3 below.

1.6 CODES AND STANDARDS

A. Systems shall conform to NFPA 101, Life Safety Code; NFPA 13, Sprinkler Systems; NFPA 14, Standpipe & Hose Systems. Use the editions enforced by the local governing authority or as directed by the Architect.

B. Where Underwriters Laboratories has established a standard for an item of equipment, use only a UL-approved item.

C. Additional codes and standards as adopted by the local governing authority shall apply. Use IRI, FM, PIAL, or other insurance standards where requested by the Owner. Inlet and outlet threads on devices connected to by the local fire department shall conform to their requirements. These requirements shall take precedence over connection sizes described elsewhere.

1.7 INSPECTIONS AND TESTS

A. Arrange and pay for all inspections, examinations and pressure and operational tests required by the authorities and/or agencies and according to applicable NFPA Standards specified. Complete and forward a copy of the Contractor's material and test certificate and forward to the authorities having jurisdiction.

1.8 COORDINATION

A. Coordinate sprinklers, piping and other system components with the final layout drawings and with work of other sections in order to avoid conflict with other work in the area. Give particular attention to the location of sprinklers to avoid conflict with air conditioning grilles, diffusers, and lights. In general, run horizontal sprinkler piping as high as the structure will allow, offset to avoid obstructions. Ductwork shall have preference. Offset overheads, horizontal runs, and piping around all ductwork and obstructions of any kind. Make offsets around structural members as necessary. See Division 26, Fire Alarm System to determine what is being furnished under that system, and coordinate work under this section with work under Division 26.

B. In areas with finished ceilings, the piping shall be run concealed. If finished ceiling is attached directly to the structural beams, coordinate installation above the ceiling with structural work. Locate sleeves within concrete beams prior to pouring concrete. Piping shall not be installed below the finished ceiling.

C. Slope horizontal piping to permit system drainage. Where horizontal piping must be vertically offset, provide drains complete with valve, cap and vents to allow complete drainage of system per NFPA 13:8.16.2.

1.9 WARRANTIES

A. Applicable paragraphs on warranties in other specification divisions and sections listed above apply to all portions of this section.

1.10 SPRINKLER SYSTEM

A. Provide a sprinkler system of sprinklers for the entire building. Small areas, such as outside covered areas may be protected by use of antifreeze as defined in NFPA 13 or dry pipe nipples and sprinklers as indicated on the drawings. System shall include sprinklers, piping, valves, valve supervisory switches, flow indicators, alarms, flow switches, gauges, drains and other necessary accessories. Provide layout plans, elevations and details, and obtain approval as outlined above before submittal to the Architect.

B. Lay out sprinklers for each occupancy classification based on materials of construction, structure, obstructions, ceiling location, and other parameters affecting the layout per NFPA 13. Hydraulically size piping grid.

C. Perform hydraulic design calculations and size piping to meet the demand of both the standpipe and the sprinklers simultaneously. Use area and density requirements of NFPA 13:11.2.3. Use occupancy hazard classification as indicated on the drawings and as defined in NFPA 13:5.2 through 13:5.6.

D. The design area may be reduced in accordance with NFPA 13 if the area and sprinklers used meet the criteria indicated.

PART 2 - PRODUCTS

2.1 HANGERS

A. Provide all NFPA 13 and 14, and UL 203 approved hangers, supports, braces, dampers, rods, inserts, flanges, anchors, guides, trapeze, and other supports to fully support horizontal and vertical runs of piping.

2.2 SPRINKLERS AND ESCUTCHEONS

A. Install sprinklers upright or pendent, as conditions require. Install the following types and in finish indicated for the building areas designated.

1. No ceiling: exposed, thermo sensitive glass-bulb type, quick response, rough, unplated.

2. Spaces with ceilings, such as storage areas, closets, other non-public areas of similar use: thermo sensitive glass-bulb type, quick response, brass finish, white escutcheons. Where required to be installed above the ceiling, they shall be as specified for no-ceiling areas.

3. All finished spaces with ceilings: pendent, semi-recessed thermo sensitive glass-bulb type, quick response, with white escutcheons.

4. In Lobby area: pendent, thermo sensitive glass-bulb type, flush mounted with cover painted by manufacturer to match ceiling color.

5. Exterior Covered Area: dry horizontal sidewall, thermo sensitive glass-bulb type, quick response, chrome finish with chrome escutcheon.

6. Sidewall Applications: sidewall, semi-recessed thermo sensitive glass-bulb type, quick response, with white escutcheon or color as selected by the architect.

7. Provide extended coverage upright or pendent sprinklers in areas as shown on the drawings. The sprinklers shall be listed and designed for the minimum flow corresponding to the density contained in Part 1 above. Sprinkler shall have a thermo sensitive glass bulb in either light hazard or ordinary hazard versions as required.

8. Use 155°F quick response ordinary degree range sprinkler temperature rating; except, in the vicinity of high heat-producing equipment, as defined in NFPA 13, increase temperature rating accordingly.

2.3 FLOW DETECTING VALVES, ALARM CHECKS, FLOW AND SUPERVISORY SWITCHES

A. Provide and install flow-detecting valves and/or alarm check or similar approved proprietary valves with necessary attachments as required by NFPA 13. Provide supervisory open position tamper switch on valves. Switch shall have 2-S.P.D.T. contacts rated for load served. Provide the required flow switches to detect water flow. Switch contact shall be rated for the load served. Work of Division 26 shall provide all conduit and wiring from flow alarm and supervisory position switches to the central fire alarm system and local and remote annunciators. Coordinate equipment to be compatible to equipment provided under Division 26.

2.4 PIPE AND FITTINGS

A. Provide piping system of either steel capable of withstanding a working pressure of 175 psig or higher pressures as required.

B. Provide Schedule 40 welded or seamless black steel with screwed fittings, ASTM A53 pipe for pipe 1 ½" and smaller. Provide Schedule 10, rolled groove joint, ASTM A53 pipe for pipe 2" and larger. For couplings and fittings, use screwed, 175# WOG cast iron and/or 300# banded, malleable iron through 1 ½"; for 2" and above, use 175# (WOG) cast iron flanged with matching screw-on or welding flanges of similar pressure rating.

C. In lieu of the above fittings for pipe 2" and larger, an approved grooved mechanical joint system may be used using mechanical couplings and grooved fittings and ASTM A135 or A795 pipe for fire protection use. Fittings shall meet ASTM A395 and ASTM A536. Light weight pipe shall have a corrosion resistance rating (CRR) of 1.0 when compared to threadable Schedule 40 pipe. Use only roll groove joints in light weight piping and on welded seam, Schedule 40 pipe.

2.5 MANUAL CONTROL VALVES - CHECK VALVES

A. Provide manual control valves/check valves in accordance with the minimum requirements of NFPA 13 and the local authorities having jurisdiction.

B. Provide shutoff valves, solid-wedge OS&Y type (indicating type of position of stem), FM & UL, 175# minimum WOG; threaded through 2", equal to Jenkins Fig. 275-U; and flanged in 2½" and up, equal to Jenkins Fig. 825A. Provide check valves, UL and FM, swing-type regrind-renew disc and seat ring, flanged 2½" and up, equal to Jenkins Fig. 629.

C. In lieu of gate valves as shutoffs, provide UL butterfly valves of tapped lug body type, 175# minimum WOG, BUNA N resilient seat for drop tight shut-off. Locate valves between self-sealing companion flanges. Butterfly valve shall have body of ductile iron; stem, stainless steel; disc, aluminum bronze; ring, phenolic. Gear operate valve through handwheel with crank having a disc position indicator and

padlocking provision. Provide zero leakage valve. Butterfly valves shall not be substituted for OS&Y valves on the suction side of the fire pump and jockey pump.

D. Provide an electric valve-position monitoring switch with 2 SPDT contacts rated for load served to register an alarm when the valve is moved toward the closed position. Wiring for this switch will be under Division 26.

2.6 OUTSIDE FIRE DEPARTMENT CONNECTIONS

A. Supply two-way flush mounted, chrome plated brass. Use siamese type, double clapper, straight inlets and outlets, 2½" hose thread, spanner-wrench operable, body marked "auto-sprinkler". Provide chain-secured caps. Locate fire department connections as shown on the drawings and/or where required by regulatory agencies. Size inlet as shown on drawings.

2.7 SPARE SPRINKLERS

A. Provide sprinkler cabinets with spare sprinklers as required by NFPA 13 and with wrenches and lock. Provide number of each type in the same ratio as those installed.

2.8 PRESSURE GAUGES

A. Provide UL-listed pressure gauges above and below the water flow detector and/or alarm valve and other points required by Code. Provide valved and plugged connections where needed for test purposes.

PART 3 - EXECUTION

3.1 PIPING

A. Install exposed piping parallel to, or at right angles to the column lines of the building wherever possible. Where pipe and sprinklers are indicated as exposed in finished areas and become a part of the space aesthetics, (architectural feature), careful coordination is required in the routing of pipe and layout of sprinklers which must be checked and approved by the Architect.

B. Conceal all piping, except in mechanical equipment rooms, laboratories, stairwells, or where otherwise indicated on the Drawings. Where finished ceiling is mounted directly to the support members, provided sleeved or cored openings in concrete beams and punched holes through sheet metal studs or C-channels. Coordinate all required penetrations through structural members with structural work.

C. Cold springing piping will not be permitted. Install piping with adequate support to prevent strain on the equipment.

D. Grade all piping to eliminate traps and pockets. Where air pockets or water traps cannot be avoided, provide manual air vent valves.

E. Install unions or flanges at equipment connections, and elsewhere as indicated on the Drawings.

F. Install piping in accordance with NFPA 13, 14, and 20 requirements. Screwed steel piping may be used through 1 ½" size and special joining methods specified herein are allowed. Cut grooves are allowed in mechanical joint systems where schedule 40 pipe is used; only a rolled groove is allowed on lightweight steel mechanically coupled piping.

G. Approved ball and butterfly valves may be used in lieu of gate or globe valves except on the suction side of the fire and jockey pumps.

H. Paint all exposed piping red, excluding valve operators and sprinklers, using 2 coats enamel per Section 099000.

3.2 TEST CONNECTIONS

A. Provide necessary test connection for the system.

3.3 DRAINS

A. Install all sprinkler pipe and fittings so that the system may be drained. Discharge all system main drains either outside or to drainage points indicated. Discharge drain in conformity with health department or plumbing regulations. Provide auxiliary drain per NFPA 13:4-14.3. When a change in piping elevation prevents drainage of sections of piping through the main drain valve.

3.4 VALVE SEALS, TAGS, CHARTS

A. Provide copper wire and approved seal for each manually-operated shut-off valve required to be sealed in open position.

B. Provide identification signs of standard design; fasten securely at designated locations per NFPA 13. Provide brass tags between 2" and 3" diameter; stamp with designating numbers; secure with 12 gauge copper wire to spindle of all control valves. Provide 2 copies of approved sprinkler system diagram and valves charting designating number, function, location of each valve. Mount in painted, glazed frames and hang where directed.

C. Secure a placard to the control valve at each point of connection to a riser showing the individual design for floor or area served.

3.5 PRESSURE TEST

A. Perform pressure test of the systems per NFPA 13, at not less than 200 psi for 2 hours.

3.6 SYSTEM TESTS

A. Flush all mains per rates in NFPA 13 until water is clear. Make provision for disposal of flushing water so as to avoid property damage.

B. Complete functional test of sprinklers, valves and controls. Complete all data and tests listed under "Contractor's Material and Test Certificate" of NFPA 13.

3.7 INSPECTIONS AND TESTS

A. All inspections, examinations, and tests required by the authorities and/or agencies specified hereinbefore shall be arranged and paid for as part of this Section, as necessary, to obtain complete and final acceptance of the system as installed. The certificates of inspection shall be in quadruplicate, and shall be delivered to the Architect for distribution.

3.8 PERIODIC INSPECTION SERVICE

A. After completion of the automatic sprinkler system, and at the beginning of the guarantee period, execute the National Automatic Sprinkler and Fire Control Association, Inc., Standard Form of "Inspection Agreement," without charge to the Owner, calling for four inspections of the sprinkler system during the warranty period. During the warranty period, inspections shall be as per the Inspection Agreement, plus the following maintenance to be performed during the course of the fourth inspection:

1. Operation of all control valves.
2. Lubrication of operating stems of all interior valves.
3. Operation of water gong, electric alarm, supervisory panel, air compression, alarm trip switches, flow switches, and similar items.
4. Cleaning of alarm valves.
5. Lubrication of Fire Department hose connection inlet.

B. These inspections shall be performed at no cost to the Owner and by a Firm qualified to do the inspections.

3.9 INSPECTION REPORT

A. The Standard Form of the National Automatic Sprinkler and Fire Control Association, Inc., "Report of Inspection," shall be filled out in triplicate after each inspection, and the copies sent to the Architect.

END OF SECTION

SECTION 22 0100

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions, (if any) and other General Requirements, apply to the work specified in this section.

B. Separation of Division 22 into Sections is for convenience only and is not intended to establish limits of work. Sections are as follows:

1. 220517 Sleeves and Sleeve Seals for Plumbing Piping
2. 220518 Escutcheons for Plumbing Piping
3. 220519 Meters and Gages for Plumbing Piping
4. 220523 General-Duty Valves for Plumbing Piping
5. 220529 Hangers and Supports for Plumbing Piping and Equipment
6. 220553 Identification for Plumbing Piping and Equipment
7. 220700 Plumbing Insulation
8. 221116 Domestic Water Piping
9. 221119 Domestic Water Piping Specialties
10. 221123 Domestic Water Pumps
11. 221316 Sanitary Waste and Vent Piping
12. 221319 Sanitary Waste Piping Specialties
13. 221429 Sump Pumps
14. 221513 General-Service Compressed-Air Piping
15. 221519 General-Service Packaged Air Compressors and Receivers
16. 221623 Facility Natural Gas Piping
17. 223400 Fuel-Fired, Domestic-Water Heaters
18. 224000 Plumbing Fixtures

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for plumbing installations and expands the requirements specified in Division 1. These requirements are: Contractor's Qualifications, Quality Assurance, Reference Codes and Standards, Permits and Inspections, Equipment and Materials, Examination of Premises, Submittals, Coordination Drawings, Record Documents, Project Closeout, Warranty, Measurements, Operation Prior to Substantial Completion, Contractor Operation Prior to Substantial Completion, Electrical Work, Painting, Protection of Equipment and Work, Rough-ins, Mechanical Installations, and Cutting and Patching.

1.3 DEFINITIONS

A. The following definitions apply to all Division 22 specification sections:

1. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
2. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
3. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
4. Installer: The term "Installer" is defined as the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. Installers shall be skilled in the work they are to perform.
5. Specialist: The term "Specialist" means an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workmen skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the contract specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.
6. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
7. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
8. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
9. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
10. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SCOPE

A. The following requirements apply to the work necessary to provide (additions and supplements to existing) plumbing system or systems, as specified in the various sections of this Division.

1.5 CONTRACTOR'S QUALIFICATIONS

A. An acceptable contractor for the work under this Division shall be a specialist in this field and have the personal experience, training and skill and the organization to provide a practical working system. If required, he shall be able to furnish acceptable evidence of having contracted for and installed not less than 3 systems of comparable size and type to this one, that have served their owners satisfactorily for not less than 3 years. The foreman for this work shall have had experience in installing not less than 3 such systems and shall be approved before work is begun.

B. Work under this Division shall only be accomplished by entities licensed under provision of Section 2163, of the Rules and Regulations of the State of Louisiana Contractors License Law, R.S. 37:2150-2164.

1.6 QUALITY ASSURANCE

A. Manufacturers:

1. Trade names, manufacturers and catalog numbers are mentioned herein and on the Drawings solely in order to establish a standard for the type, general design and quality of product required. Other products similar in design, of equal quality and complying with the Drawings and Specifications will be considered after the contract is let only for those items with which the expression "or approved equal" is used. Where two or more manufacturers or materials are named, the Contractor may submit any of those named, provided they conform to the Specification. Identification in the project documents of any product by name, manufacturer or model number does not include either expressed or implied warranty of unqualified product acceptance. All products must be capable of proper installation in the spaces provided, readily maintained and must satisfy other requirements contained in the contract documents.
2. If manufacturer and/or model number is indicated in the Contract Documents, it is for the purpose of identifying the product that is the “Basis of Design”. The means the product has been used as the basis for coordination for all architectural, structural, electrical, & mechanical requirements. If a manufacturer and/or model number other than the one named is procured, the Contractor shall be responsible for all changes necessary including additional design services incurred by the Owner to allow the installation of the selected product. It shall be the Owner's sole discretion to determine if additional design assistance is needed. Owner shall be compensated by the Contractor for the cost of the additional service to the Architect and/or Engineer to change

the design and/or review the equipment placement changes elected to be made by the Contractor.

1.7 REFERENCE CODES AND STANDARDS

A. Requirements set forth in reference codes and standards are minimum for equipment, material and work. In instances where capacities, size, etc., of equipment, devices or materials listed in the Contract Documents exceed these minimums, listed or shown capacities, etc. shall prevail.

B. Comply with applicable laws, ordinances, codes and rules, with latest revisions adopted by the authority having jurisdiction , of the following governing codes and agencies:

1. International Mechanical Code
2. Sanitary Code of the State of Louisiana
3. Part XIV (Plumbing) of the Sanitary Code, state of Louisiana (LAC 51: XIV), Louisiana State Plumbing Code.

C. Local laws and codes take precedence over state laws and codes, which, in turn, take precedence over national codes and industry standards.

D. Comply with the requirements of the ASME Unfired Pressure Vessel Code. All pressure vessels shall be stamped "ASME" and "National Board". Furnish to the Owner for each pressure vessel supplied under this Specification, a manufacturer's data report for unfired pressure vessels, Form U-I, as required by the ASME Code Rules.

E. This form must be signed by a qualified inspector holding a National Board Commission, certifying that construction conforms to the latest ASME Code for Unfired Pressure Vessels. The ASME symbol "U" also shall be stamped on each vessel.

F. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 “Reduction of Lead in Drinking Water Act.”

1.8 PERMITS AND INSPECTIONS

A. Permits and Fees: Obtain and pay for all permits. Pay fees and all other payments required by utility regulatory bodies in connection with the Work. Pay for all inspections required under local codes with regard to the Work.

B. Certificates of Inspection: Upon completion of the work, furnish certificates of inspection from all inspection or regulatory agencies having jurisdiction over work of Division 22.

1.9 EQUIPMENT AND MATERIALS

A. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. The plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

B. The label of the approving agency, such as UL, AGA, ASME, ARI, AMCA, by which a standard has been established for the particular item, shall be in full view.

C. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be the manufacturer's latest design.

D. Deliver equipment and materials to the site and store in original containers, suitably sheltered from physical damage and the elements, but readily accessible for inspection. Equipment damaged in shipment will not be acceptable.

1.10 EXAMINATION OF PREMISES

A. Visit the site of the proposed work before bidding. Inspect the site and become familiar with the difficulties and restrictions attending the execution of the contract.

B. No additional compensation will be allowed for failure to be informed of site conditions.

1.11 SUBMITTALS

A. General:

1. Submit for review shop drawings, product data and samples. Comply with requirements of Division 1 Section "Submittals". Minimum number of copies shall be four (4). Mark each individual item with pertinent specification section and paragraph number. Submittal will be rejected if specification and paragraph number under which it is being submitted is not identified.
2. If the submittal deviates from the requirements of the Contract Documents, the deviation shall be identified in writing on the first page of the submittal. Identify where within the Contract Documents the deviation occurs. The deviation shall only be considered acceptable if the identified deviation has been initialed by the Engineer. Any deviation not initialed may be assumed to be rejected. All coordination required due to the deviation, such as space allocation, changes to electrical service, or any other required changes shall be born as Work of Division 22 but accomplished by Installers skilled in the Work being performed. No costs incurred by the approved deviation shall be born by the Owner.
3. Review of shop drawings and submittals does not relieve the Contractor of responsibility for compliance with the specific requirements of the Contract

Documents, or for fitting the equipment in the space allotted, with proper space for connection of piping or ductwork and for servicing or for coordination of the work with work of other trades. Approval of deviations also does not relieve the Contractor of responsibility for compliance with all other aspects of the Contract Documents.

4. Review is for general conformance with the design concept of the project and general compliance with the information given in the project documents. Responsibility for confirming and correlating all quantities and dimensions, selecting fabrication processes and establishing techniques of construction resides with Contractor. Review subcontractors' submittals and shop drawings and indicate by rubber stamp or letter that they have been reviewed and approved before forwarding them. Submittals and Drawings will be returned after review indicating whether or not exceptions are taken and the required procedure to be followed thereafter. Revised and acceptable submittals and shop drawings are required before construction is begun. Include dimensional data and weights of equipment. Include motor manufacturers' names.
5. In general, the Architect and/or his consultants will review each submittal as indicated above. If submittal does not comply with the Contract Documents as indicated by the submittal being marked "REJECTED" and "RESUBMIT", general contractor shall be responsible to the Owner for any additional costs the Owner incurs due to review of follow-on submittals.

B. Samples:

1. Submission of samples may be required by the Architect, particularly where equipment is visible in finished areas. Arrange demonstrations of a product's ability to perform as specified if required. Include dimensional data and weights of equipment. Include motor manufacturers' names.

C. Product Data:

1. Submit product data within 45 days after award of the Contract and before any equipment or materials are purchased. Product data is defined as manufacturers' printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp "No exception taken" on submittal is required before ordering equipment unless otherwise noted.
2. Submit items identified in the individual Sections. If product data have not been received within 45 days after award of the Contract, only the manufacturer named shall be allowed e.g. if "American Standard or approved equal" is stated in the Contract Documents, after 45 days only the American Standard product shall be allowed.

1.12 COORDINATION DRAWINGS

A. Prepare and submit a complete set of Construction Coordination Drawings utilizing the dimensions of the actual equipment to be utilized and indicating the exact

routing for all elements such as piping, cable tray, conduit, ductwork, fire sprinkler lines, etc., including conduit embedded in concrete, and paying close attention to sloped plumbing lines such as sanitary and storm sewer. Use the architectural and structural drawings as the base drawings to which all trades shall add their work.

Provide Plan Views as well as sufficient Elevations and Sections to assure and demonstrate installation sequencing, access, and space coordination upon review.

Complete each Coordination Drawing and include on the drawing sign-off by each individual trade performing work in the affected area, as well as the Contractor. No work shall commence in the area covered by the specific drawing until review and acceptance of drawing. This requirement for Coordination Drawings is not authorization for the Contractor or individual trades to make any unauthorized changes to the Contract Drawings. Maintain all Design Drawing space allocations such as ceiling heights (maintaining an eight (8) inch high zone directly above the ceiling for flexibility), chase wall dimensions, equipment room sizes, etc., unless prior written authorization is received from the Architect to deviate.

Work installed by a trade which interferes with work of any other trade will be corrected at no cost to the Owner.

The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions reviewed by the Engineer, or for deviations from requirements in the Contract Documents. Understand clearly that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

B. Indicate the proposed locations of piping, equipment, and materials and include vertical measurement from floor to bottom of piping, and elevated equipment. Piping drawings shall include access panel locations, valves, sleeves, location of supports, etc. Vertical measurement shall be indicated at all changes in direction of piping. Measurement shall be made to the outside surface of exterior insulated piping. Measurements shall include clearances for installing and maintaining insulation; servicing and maintaining equipment; space for equipment disassembly for periodic maintenance; and showing areas for tube, filter, and coil removal. Provide details of connections and supports, exterior wall and foundation penetrations, sizes and locations of concrete housekeeping pads, and indicate space for valve stem movement. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Include location of sleeves in floors, walls, and ceilings. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication system components, sprinklers, smoke detectors, and other ceiling mounted items.

D. Provide digital copies of final coordination drawings, separated by trade, to the owner in dwg and/or pdf file formats.

1.13 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Project Closeout". As a minimum, record documents shall show piping systems with valves and control devices location and numbered according to tags; concealed unions and items requiring maintenance such as traps, strainers, expansion compensators, expansion and compression tanks. Locate all access panels installed to maintain mechanical equipment. Reference prominent building lines when showing dimensions of equipment, pipe and access panels. Identify installations different from the original plans due to product substitutions, Contract Modifications, and actual equipment and material installed. All elements underground shall be shown giving actual inverts and horizontal locations. Engage the services of a Land Surveyor or Professional Engineer registered in the State in which the project is located to record locations and invert elevations of underground installations. Complete this survey work prior to the covering of the underground installation.

B. Provide digital copies of final record documents, separated by trade, to the owner in dwg and/or pdf file formats.

1.14 PROJECT CLOSEOUT

A. Mark and otherwise correct a set of reproducible drawings to reflect the final location of all work installed under Division 22, to serve as record documents, in accordance with Division 1 Section "Project Closeout". Locate cleanouts, valves, traps, manual and automatic dampers, fire and smoke dampers, control sensing elements in ducts, and other concealed items requiring adjustment or maintenance. Supplement with additional sketches on tracing paper for clarification, if necessary. Certify in writing that record drawings have been checked and are accurate. Submittal of these documents is a prerequisite for certification of substantial completion. Contractor may obtain a set of reproducible drawings from the Architect and shall pay for them.

B. Conform to other requirements included in Division 1 Section, "Project Closeout".

1.15 WARRANTY

A. Refer to applicable paragraph under GENERAL CONDITIONS. Warrant all materials and workmanship for a period of one year. Repair or replace promptly defects due to faulty materials, methods of installation or workmanship, with the least inconvenience and without expense to the Owner and at time designated by the Architect within the one-year period. Additional specific performance or extended

time warranties called for in the individual sections under this Division must be provided.

B. The warranty period for mechanical work shall commence on the date certified by the architect or engineer that the contract is substantially complete in accordance with the plans and specifications, or upon beneficial use by the Owner, whichever occurs first. When beneficial use is for only a portion of the work, the warranty shall commence only on that portion of the work.

1.16 MEASUREMENTS

A. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Study carefully the sizes and locations of structural members, wall and partition locations, attic spaces, ceiling furring, chase spaces and room dimensions and take actual measurements on the job. Locate ductwork, piping, equipment and accessories, with sufficient space for installing, insulating and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment, piping or ductwork can not be fitted, the Architect shall be consulted. All equipment, apparatus and materials must fit into the available, designated spaces, with proper clearances for maintenance, service and repair.

1.17 OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Owner shall have the right to operate systems and equipment prior to substantial completion, as soon as tested and operational, provided all safety devices have been installed. Agreement between Owner and Contractor relative to time and hours of operation and responsibility for start up and shutdown is required. Do not permit operation which may damage equipment or cause damage to the building or to the work of other contractors. Air filters must be in place on air conditioning units and strainers must be in place in all piping systems prior to operation.

1.18 CONTRACTOR OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Obtain written authorization from the Owner for Contractor's use of equipment. If equipment is allowed to be used during construction period, all start-up requirements for the equipment shall be adhered to prior to operation including start-up procedures, required equipment check-out by factory authorized representatives, required equipment inspection reports, and commissioning as required in the individual Sections. A copy of operating and maintenance manuals shall be kept on-site while equipment is in operation. These manuals shall be made available to Owner's maintenance crews if Contractor is off-site and equipment is still in operation. In addition, no sooner than seven days prior to Substantial Completion being granted, original equipment check-out by factory authorized

representative, required equipment inspection reports, and commissioning shall be completed a second time. Equipment or components found not in compliance with the Contract Documents shall be replaced without cost to the Owner. Submit by letter to the Owner the date in which each piece of equipment is put into operation.

B. Maintain duct cleanliness during air handling equipment use by installing minimum 30% filter material over all return and exhaust openings. If duct cleanliness is found by the Architect to be unacceptable, duct shall be cleaned with alcohol impregnated pad and pad changed as it loads with dirt. Provide additional access panels within the ductwork allowing cleaning to be completed. Added access panels required for this remedial cleaning shall be provided at no cost to the Owner.

1.19 ELECTRICAL WORK

A. General:

1. Electrical service shall be as indicated on the Drawings. All power wiring and all circuit breakers, starters, disconnect switches, pilot lights, hand-off-automatic (H-O-A) switches, pushbutton stations, except such items which are provided as part of "packaged" mechanical equipment or specifically noted herein, shall be furnished, set in operating position, and electrically connected as work of DIVISION 26, ELECTRICAL.

2. Should the Contractor desire to use equipment requiring larger motors or electrical characteristics differing from those shown, it is the responsibility of work requirements under Division 23 to inform other affected parties of the proposed changes to permit them to supply proper wiring, disconnects and starters. Additional costs incurred to work of other Divisions caused by such changes shall be borne as work of Division 23. Coordination to establish areas of possible change between Division 23 work and work of another Division shall occur prior to equipment delivery from the manufacturer.

B. Starters: Motor starters furnished with mechanical equipment covered by this section shall conform to the requirements of Division 26. Provide motor overload protection requirements for sizing overload protection device for motor starters furnished under Division 26.

C. Conduit and Wiring: As work of Division 22, all interlock conduit and wiring and control conduit and wiring shall be provided, and all control elements shall be set in position and connected. Provide control transformers and additional relays required for interface with the electrical system. Unless indicated otherwise, power wiring and conduit for all devices shall be work of Division 26.

1.20 PAINTING

A. Painting shall be done under Division 09, except for touch-up of factory finishes on equipment located inside and outside. Obtain matched color coatings from the

manufacturer and apply as directed. Prime coating of certain equipment is specified under individual equipment specification. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint in accordance with requirements of Division 09.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT AND WORK

A. Continuously maintain adequate protection of stored materials and installed work. Tightly cover fixtures and equipment, with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust and moisture. Provide heat to equipment being stored to prevent condensation. Do not store materials and equipment outside, directly on the ground, or in areas where it may be subject to physical injury from vehicular traffic or construction machinery. Piping and equipment installed under this Division shall not be used by other trades as supports for scaffolds or personnel. Do not deliver controls or other delicate equipment to the job site unless they can be placed in protected areas. At work completion, clean equipment, fixtures, exposed ductwork and piping, including hangers and supports to the Architect's satisfaction.

3.2 ROUGH-IN

A. Verify the final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to equipment specifications in Divisions 2 through 28 for rough-in requirements.

3.3 PLUMBING EQUIPMENT INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components during progress of construction to allow for mechanical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence and coordinate installation of large pieces of equipment prior to closing in the building.

B. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect with a suggested resolution. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building components, where installed exposed. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

D. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components without requiring the removal of permanent construction or disabling the function of a required fire-resistance-rated assembly. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Provide access panel or doors where equipment is concealed behind finished surfaces. See Division 08 Section "Access Doors" and Division 22 Section "Basic Plumbing Requirements".

E. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope. In general, ductwork shall take precedence over piping. Set system elevations to minimize offsets where systems cross. Make full use of all three dimensions and stack ductwork, equipment, and accessories vertically as required. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "Cutting and Patching". Engage experienced Installers in cutting and patching this work. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. See Division 1 Section "Definitions and Standards" for definition of "experienced Installer". Protect adjacent installations during all cutting and patching operations.

B. Perform cutting, fitting, and patching for plumbing equipment and material installation. Uncover work to provide for installation of ill-timed work. Remove and replace defective mechanical work and work not conforming to requirements of the Contract Documents. Install equipment and materials in existing structures. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.

C. Upon written instructions from the Architect, uncover and restore work to provide for Architect observation of concealed work covered prior to inspection. Uncovering and restoring work required to be observed by the Architect prior to covering as identified in the Contract Documents will be at no cost to the Owner.

D. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items as identified in the Contract Documents. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers.

END OF SECTION

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SECTION 22 0517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

H. Polyethylene sleeve shall be manufactured of virgin material conforming to the following and listed in ASTM D-1248.

1. Tensile Strength: MD-3400 psi; TD-2800 psi.
2. Density: 924.
3. Elongation: MD-300% TD-500%,
4. Thickness: 0.006" tolerance not to exceed 10%.
5. Colors: Natural, Blue, Orange, and custom.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 POLYETHYLENE SLEEVE INSTALLATION

A. Cut a desired length, slip over the pipe pulling it over the barrel length. Joints in the polywrap should be overlapped a minimum of six inches. Repair any damage to the

polywrap with tape or a short length of polywrap cut and wrapped around the pipe and secured in place.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than 6” NPS: Cast-iron wall sleeves, Galvanized-steel wall sleeves, Galvanized-steel-pipe sleeves, or Sleeve-seal fittings.
   b. Piping 6” NPS and Larger: Cast-iron wall sleeves, Galvanized-steel wall sleeves, or Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than 6” NPS: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping 6” NPS and Larger: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, or Galvanized-steel-pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than 6” NPS: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping 6” NPS and Larger: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Galvanized-steel-pipe sleeves.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   c. Copper tubing 3/4” NPS and smaller: Polyethylene sleeve.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than 6” NPS: Galvanized-steel-pipe sleeves, Stack-sleeve fittings, or Sleeve-seal fittings.
    b. Piping 6” NPS and Larger: Galvanized-steel-pipe sleeves or Stack-sleeve fittings.

5. Interior Partitions:

    a. Piping Smaller Than 6” NPS: Galvanized-steel-pipe sleeves.
    b. Piping 6” NPS and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 0518

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors. This includes waste and water on fixtures concealed under cabinets.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass with polished, chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 0519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Thermowells.
5. Dial-type pressure gages.
6. Gage attachments.
7. Test plugs.
8. Test-plug kits.

B. Related Sections:

1. Division 21 Section "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Division 21 fire-suppression piping Sections for fire-protection pressure gages.
3. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
4. Division 22 Section " Domestic Water Piping" for water meters inside the building.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch or 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, rigid, back and rigid, bottom, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Standard: ASME B40.200.
2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Pointer: Dark-colored metal.
7. Window: Glass.
8. Ring: Stainless steel.

9. Connector Type(s): Union joint, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

11. Accuracy: Plus or minus 1 percent of scale range.

B. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Standard: ASME B40.200.
2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back or front flange and holes for panel mounting.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Pointer: Dark-colored metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Connector Type(s): Union joint, back or bottom; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

11. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle or Straight unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch, with ASME B1.1 screw threads.

9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CNR or CUNI.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back or front flange and holes for panel mounting.

3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.6 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 , ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.8 TEST-PLUG KITS

A. Furnish one test-plug kits containing two thermometers, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig .

E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct or Remote-mounted, metal-case, vapor-actuated type.
3. Direct or Remote-mounted, light-activated type.
4. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct or Remote-mounted, metal-case, vapor-actuated type.
3. Direct or Remote-mounted, light-activated type.
4. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:

1. Liquid-filled or Sealed, bimetallic-actuated type.
2. Direct or Remote-mounted, metal-case, vapor-actuated type.
3. Direct or Remote-mounted, light-activated type.
4. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

C. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Sealed, direct -mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Sealed, direct -mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi.

B. Scale Range for Domestic Water Piping: 0 to 200 psi.

END OF SECTION

SECTION 22 0523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Bronze ball valves.
3. Iron ball valves.
4. Iron, single-flange butterfly valves.
5. Iron, grooved-end butterfly valves.
6. Bronze swing check valves.
7. Iron swing check valves.
8. Iron swing check valves with closure control.
9. Iron, grooved-end swing check valves.
10. Iron, center-guided check valves.
11. Iron, plate-type check valves.
12. Bronze gate valves.
13. Iron gate valves.
14. Bronze globe valves.
15. Iron globe valves.
16. Lubricated plug valves.
17. Chainwheels.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. Comply with NSF 61 and ANSI 372 for potable domestic water piping and components.

D. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 “Reduction of Lead in Drinking Water Act.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

2.3 BRONZE BALL VALVES

A. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

2.4 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated ductile iron.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 175 psig.
c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Coated, ductile iron.
f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. Description:

a. Standard: MSS SP-67, Type I.
b. NPS 8 and Smaller CWP Rating: 300 psig.
c. NPS 10 and Larger CWP Rating: 200 psig.

d. Body Material: Coated, ductile iron.
e. Stem: Two-piece stainless steel.
f. Disc: Coated, ductile iron.
g. Seal: EPDM.

2.7 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.9 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and weight.

2.10 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Description:

a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring-operated, ductile iron or stainless steel.

2.11 IRON, CENTER-GUIDED CHECK VALVES

A. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Bronze Seat:

1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

2.12 IRON, PLATE-TYPE CHECK VALVES

A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Description:

a. Standard: API 594.
b. CWP Rating: 200 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 126, gray iron.
e. Seat: Bronze.

2.13 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.

f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.14 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.

d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.15 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

2.16 IRON GLOBE VALVES

A. Class 250, Iron Globe Valves:

1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

2.17 LUBRICATED PLUG VALVES

A. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

C. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 400 psig.
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

D. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 400 psig.
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

2.18 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball, butterfly, and plug valve stems.
3. Sprocket Rim with Chain Guides: Ductile or cast iron, Aluminum, Bronze, of type and size required for valve.
4. Chain: Hot-dip, galvanized steel or Stainless steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary. If easy access is not available, install metal access panel. Coordinate access panel with architect.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or plug valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or butterfly, valves.
4. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
   b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two-piece, regular port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron, Single-Flange Butterfly Valves: 200 psi CWP, EPDM seat, aluminum-bronze or nickel-plated ductile-iron disc.
4. Iron, Grooved-End Butterfly Valves: 175 or 300 psi CWP.
5. Iron Swing Check Valves: Class 125, metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
7. Iron, Grooved-End Swing Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 250, compact-wafer, bronze seat.
9. Iron, Plate-Type Check Valves: Class 125 dual plate; metal seat.
10. Iron Gate Valves: Class 250, NRS.
11. Iron Globe Valves: Class 250.

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SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.
9. Miscellaneous Materials

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.Retain option in first subparagraph below if manufacturer's name and model number are indicated in schedules or plans on Drawings; delete option and insert manufacturer's name and model number if not included on Drawings.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7.
8. Metallic Coating: Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Retain option in first subparagraph below if manufacturer's name and model number are indicated in schedules or plans on Drawings; delete option and insert manufacturer's name and model number if not included on Drawings.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Coating: Paint.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig orASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig or[ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections or Section "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
3. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
4. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
5. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Carbon-Steel Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

11. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
12. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment Nameplates and labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.
5. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Color codes used on safety signs, labels, and tags shall comply to ANSI Z 535.1-2006.

PART 2 - PRODUCTS

2.1 EQUIPMENT NAMEPLATES AND LABELS

A. Engraved or Stamped Metal Nameplates for Equipment:

1. Material and Thickness: Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Engraved Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 1 inch in high.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Nameplate Content: Include manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and similar essential data.

D. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and

schedules), plus the Specification Section number and title where equipment is specified.

E. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

F. Non-metal ceiling markers for Equipment and Piping above ceiling:

1. Self adhesive color sticker, 1/2” diameter.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: According to ASME A13.1.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd enamel or acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel or acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Attach self adhesive label at ceiling grid or access panel to indicate location of all above ceiling plumbing equipment such as shut-off valves, water heaters, pumps, etc.

C. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "High-Performance Coatings."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: White.
   b. Letter Color: Black.

3. Natural Gas

   a. Background Color: Yellow.
   b. Letter Color: Black.

4. Acid Waste

   a. Background Color: Orange.
   b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:

   a. Cold Water: Natural.
   b. Hot Water: Natural.

3. Letter Color:

   a. Cold Water: Black.
   b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 0700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

   a. Flexible elastomeric.
   b. Mineral fiber.
2. Adhesives.
3. Mastics.
4. Sealants
5. Factory-applied jackets.
6. Field-applied jackets.
7. Tapes.
8. Securements.
9. Corner angles.

B. Related Sections include the following:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing as required.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

1. 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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. 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).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. 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).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. 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).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

5. 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).

B. ASJ Flashing Sealants, and Vinyl, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. 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).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. 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 is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Finish and thickness are indicated in field-applied jacket schedules.
    b. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    c. Moisture Barrier for Outdoor Applications: 2.5-mil- thick Polysurlyn.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, galvanized and stainless steel for outdoors.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic or tape.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with ASJ tape.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Self seal lap jacket or ASJ tape.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, tape, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.
7. Valves.
8. Strainers.
9. Flanges.
10. Unions.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands or tape. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.

8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or fiberglass fill insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with tape or self seal lap jacket.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with tape or self seal lap jacket.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as

recommended by insulation material manufacturer and seal with vapor-barrier mastic.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with FSK tape.

C. 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.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. 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 aluminum bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Domestic hot-water storage tank insulation shall be one of the following, of thickness to provide an R-value of 12.5:

1. Mineral-fiber pipe and tank.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot and Recirculated Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
b. Flexible Elastomeric: 3/4 inch thick.
c. Fiberglass: 1 inch thick (cold), 1 inch thick (hot), 1 inch thick (recirculated)

B. Stormwater, Roof Drain and Overflow:

1. Insulation is only required for piping located above a ceiling. Piping located in vertical chases shall not be insulated.

2. All Pipe Sizes: Insulation shall be one of the following:

a. Mineral-Fiber, Blanket insulation: 1 ½ ” inch thick, ¾ # blanket.

C. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick.

D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 3/4 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

c. Blanket Insulation: 1 ½" thick, ¾ # blanket.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot and Recirculated Water:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inches thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inches thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:

1. Aluminum, or Stucco Embossed 0.016 thick.

END OF SECTION

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SECTION 22 1116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.
5. Water meters furnished by utility company for installation by Contractor.
6. Water meters.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Backflow preventers and vacuum breakers.
6. Water penetration systems.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping.
3. Compressed air piping.
4. HVAC hydronic piping.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 and ANSI 372 for potable domestic water piping and components.

D. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 “Reduction of Lead in Drinking Water Act.”

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's and Owner's written permission.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Copper Push-on-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.

7. Copper-Tube Extruded-Tee Connections:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    b. Description: Tee formed in copper tube according to ASTM F 2014.

8. Grooved-Joint Copper-Tube Appurtenances:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    b. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
    c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.

    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.

    a. Gaskets: AWWA C111, rubber.

2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.

    a. Gaskets: AWWA C111, rubber.

C. Plain-End, Ductile-Iron Pipe: AWWA C151.

1. Grooved-Joint, Ductile-Iron-Pipe Appurtenances:

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
   c. Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.4 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

1. Fittings for PEX Tube (Crosslinked polyethylene plastic):

   a. ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
   b. ASTM F 1960, cold expansion fittings and cross-linked (PEX) reinforcing.

2. Manifold:

   a. Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.
   b. Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASSTM F 1960; with plastic or corrosion-resistant-metal valve for each outlet.

2.5 POLYPROPYLENE PIPE AND FITTINGS

A. Polypropylene Piping System System:

1. Pipe and Piping Products: Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. Pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in a three layer extrusion process. Domestic hot water shall contain a fiber layer (faser) to restrict thermal expansion. All pipe comply with ASTM F 2389, NSF 14, and NSF 61.
2. Fittings: Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. All fittings comply with ASTM F 2389, NSF 14, and NSF 61.

3. Valves: Valves shall be manufactured in accordance with the manufacturer's specifications and shall comply with the performance requirements of ASTM F 2389. The valves shall contain no rework or recycled thermoplastic materials except that generated in manufacturer's own plant from resin of the same specification from the same raw material.
4. Plenum-rated Piping System: Shall be pre-insulated or field insulated, and when tested with standard un-insulated fittings per ASTM E84, the system consisting of wrapped or coated pipe and bare fittings shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50.
5. UV Protection: Where exposed to direct UV light for more than 30 days, it shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.
6. Integral Thermal and Vapor Barrier: Where up to 1 inch of standard insulation is indicated on the drawings or in these specifications, a factory installed, thermal (radiant, conductive, and convective) and vapor barrier insulation shall be provided. Where more than 1 inch of standard insulation is indicated on the drawings or in these specifications, additional overlap of factory installed, thermal (radiant, conductive, and convective) and vapor barrier insulation shall be provided to ensure equivalent thermal resistance. The thick wall, self insulating fittings do not require an additional vapor barrier for the piping system to meet this performance level. The thermal barrier is UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth. The pipe with the integral thermal barrier with standard unprotected fittings shall meet the ASTM E84 and the CAN/ULC S102.2 requirements for a Flame Spread Rating of 25 and Smoke Development rating of 50.

2.6 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet or Tube.

C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

D. Color: Black or Natural.

2.7 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.8 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.9 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 175 psig minimum.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Description:

a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.10 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

H. Install domestic water piping level without pitch and plumb.

I. Rough-in domestic water piping for monitoring water-meter installation according to manufacturers requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping adjacent to equipment and specialties to allow service and maintenance.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install PEX piping with loop at each change of direction of more than 90 degrees.

S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

T. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

U. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

V. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

Z. Polypropylene Piping System: Fire stopping shall be provided to both be compatible with and meet the requirements of SASTM E 814 or ULC S 115, Fire Tests of Through-Penetration Firestops'. Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.

J. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.

K. Steel-Piping Grooved Joints: Cut or roll groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Push-Fit Fitting: Push-fittings that can be used with one or more of the following materials:

1. PEX tubing complying with ASTM F876 or CSA B137.5
2. Copper tubing hard drawn Type K. L and M and annealed Type M not to exceed 3/8” nominal, comply with ASTM B 88.3.
3. CPVS tubing complying with ASTM D 2846 or CSA B 137.6.
4. PE-RT tubing complying with ASTM F 2769

N. PEX Piping Joints: Join according to ASTM F 1807 or ASTM F1960.

O. Fusion Welding of Joists: Join according to ASTM D 2657 or ASTM F 1290.

1. Fusion Welding of Joints: Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting type. All fusion-well joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

2. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

3. Prior to joining, the pipe and fittings shall be prepared in accordance with F 2389 and the manufacturer's specifications.

4. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

P. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly

open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 and Smaller: Fitting-type coupling.
2. NPS 2 and Larger: Sleeve-type coupling.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings, nipples, or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits, or nipples.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 32 inches with 3/8-inch rod.

J. Install hangers for vertical PEX piping every 48 inches.

K. Install polypropylene piping with following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches; minimum rod size, 3/8 inch.

2. NPS 3: Maximum span, 60 inches; minimum rod size, 1/2 inch.

3. NPS 4: Maximum span, 72 inches; minimum rod size, 5/8 inch.

L. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Pipe Label to include for piping system name, arrow for direction of flow, and for hot water piping system 140°F and greater, include the temperature in degree Fahrenheit.

C. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Test of water distribution system, upon the rough-in completion of a section of the entire water distribution system, cap subject piping to static water pressure of not less than 200 psi for at least 15 minutes. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building service piping, NPS 4 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.

2. Polypropylene (PP-R) piping in SDR 7.4 or heavier.

E. Under-building-slab, domestic water, building-service piping, NPS 4 and larger, shall be one of the following:
1. Mechanical-joint, ductile-iron pipe; standard or compact pattern mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard or compact pattern push-on-joint fittings; and gasketed joints.
3. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

F. Under-building slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; standard or compact pattern mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard or compact pattern push-on-joint fittings; and gasketed joints.
3. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

G. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard drawn copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings joints.
2. Polypropylene (PP-R) piping in SDR 7.4 or heavier.

H. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. In mechanical rooms and within 8 feet from source of water heating, provide Hard copper tube, ASTM B 88, Type L; cast or wrought copper solder-joint fittings; and brazed or soldered joints.
2. All other locations,
   a. PEX Tube, fittings for PEX tube; and crimped joints.
   b. Polypropylene (PP-R) piping in SDR 6, 7.4 or 11 based on the required minimum pressure rating and use temperature.

I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.
3. Polypropylene (PP-R) piping in SDR 6, 7.4 or 11 based on the required minimum pressure rating and use temperature.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

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SECTION 22 1119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Drain valves.
12. Water hammer arresters.
13. Air vents.
14. Trap-seal primer valves.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.
3. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Division 22 Section "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
6. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 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. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.

2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

C. Comply with ANSI 372 for potable domestic water piping and components.

D. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 “Reduction of Lead in Drinking Water Act.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: 1/4" NPS to 3” NPS, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Standard: ASSE 1020.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Size: 3/8" NPS to 1” NPS, as required to match connected piping.
5. Accessories:

   a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Standard: ASSE 1035.
2. Size: 1/4" NPS or 3/8” NPS matching faucet size.
3. Body: Bronze.
4. End Connections: Threaded.
5. Finish: Chrome plated.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: 1/2" NPS or 3/4" NPS, as required to match connected piping.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
4. Size: 1-1/4” NPS or 3” NPS, as required to match connected piping.
5. Body: Bronze for 2” NPS and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for 2-1/2” NPS and larger.
6. End Connections: Threaded for 2” NPS and smaller; flanged for 2-1/2” NPS and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of 2” NPS and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of 2-1/2” NPS and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Dual-Check-Valve Backflow Preventers:

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications.
3. Size: 1/4" NPS to 1-1/4”NPS, as required to match connected piping.
4. Body: Bronze with union inlet.

D. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Standard: ASSE 1022.
2. Operation: Continuous-pressure applications.
3. Size: 1/4" NPS or 3/8” NPS.
4. Body: Stainless steel.
5. End Connections: Threaded.

E. Hose-Connection Backflow Preventers:

1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: 1/2" NPS or 3/4” NPS.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

F. Backflow-Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Standard: ASSE 1003.
2. Pressure Rating: Initial working pressure of 150 psig.
3. Design Outlet Pressure Setting: 60 psig or as noted on drawings
4. Body: Bronze with chrome-plated finish for 2” NPA and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for 2-1/2”NPS and 3” NPS.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for 2” NPA and smaller; flanged for 2-1/2”NPS and 3” NPS.

B. Water Control Valves:

1. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
2. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
3. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

   a. Size: As required to match connected piping.
   b. Pattern: Globe-valve design.
   c. Trim: Stainless steel.
4. Design Outlet Pressure Setting: 60 psig or as noted on drawings.
5. End Connections: Threaded for 2" NPA and smaller; flanged for 2-1/2"NPS and larger.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
2. Body: Brass or bronze.
3. Size: Same as connected piping, but not larger than 2" NPS.
4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
2. Size: Same as connected piping, but not smaller than 2-1/2" NPS.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Individual-Fixture, Lead Free Water Tempering Valves, TM-1:

1. Standard: ASSE 1070, temperature actuated mixing valves for hot water distribution systems.
2. Pressure Rating: 125 psig minimum, unless otherwise indicated.
3. Body: Bronze body with corrosion-resistant interior components.
4. Temperature Control: Adjustable.
5. Inlets and Outlet: Threaded.
6. Finish: Rough or chrome-plated bronze.
7. Tempered-Water Setting: 105 deg F.
8. Cabinet: Recessed stainless steel cabinet with hinged door and lock

9. Tempered-Water Design Flow Rate: 0.25 gpm min.

B. Manifold, Thermostatic, Lead Free Water-Mixing-Valve Assemblies, TM-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard Valve Company New Generation High low System type TM as indicated on plumbing plans or a comparable product by one of the following:

   a. Armstrong International, Inc.
   b. Powers; a Watts Industries Co.

2. Description: Factory-fabricated, exposed-mounting, thermostatically controlled, water-mixing-valve assembly in two-valve parallel arrangement.
3. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
4. Small-Flow Parallel: Thermostatic water mixing valve.
5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
6. Pressure Ratings: 125 psig minimum, unless otherwise indicated.
7. Tempered-Water Setting: 120 deg F.
8. Unit Minimum Tempered-Water Design Flow Rate: 1 gpm
9. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
10. Piping Finish: Copper.

C. Lead Free Drench or Combination Shower Emergency Mixing Valve Assembly, TM-4:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard Valve Company model TM-600-CP-STSTL-REC or a comparable product by one of the following:

   a. Armstrong International, Inc.
   b. Powers; a Watts Industries Co.

2. Description: Factory assembles and test thermostatic water mixing valve to provide tepid water in accordance with ANSI Z 358.1 to single drench or combination shower with stainless steel cabinet. Provide with bimetal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature or pressure fluctuations. Provide with locking temperature regulator to prevent accidental movement set for for 85 deg. F.
3. Standard: ASSE 1071, Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.
4. Pressure Rating: 125 psig minimum, unless otherwise indicated.
5. Connections: Threaded inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, color coded dial thermometer (0 to 140 deg. F., -10 deg. to 60 deg. F), shutoff valve, vacuum breaker, and adjustable, temperature-control handle.

7. Cabinet: Factory-fabricated, stainless steel, for recessed.
8. Tempered-Water Setting: Adjustable high temperature limit stop set for 85 deg. F.
9. Tempered-Water Design Flow Rate: 20 gpm.
10. Tempered-Water Outlet Size: 1” NPS.
11. Hot- and Cold-Water Inlet Size: 3/4" NPS.
12. Finish: Chrome plated.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for 2” NPS and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded 2” NPS and smaller; flanged for 2-1/2” NPS and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

   a. Strainers 2” NPS and Smaller: 0.033 inch.
   b. Strainers 2-1/2” NPS to 4” NPS: 0.045 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.7 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
3. Faucet: Combination, valved fitting for hot- and cold-water with integral hammer arresters, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: 1/2" NPS ball valves and 1/2" NPS copper, water tubing.
5. Drain: 2” NPS standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Mounting: Recessed.

2. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include 1/2" NPS or smaller copper tube outlet.
4. Supply Shutoff Fitting: 1/2" NPS ball valve and 1/2" NPS copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs, HB-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide WOODFORD Model 24 or a comparable product by one of the following:

   a. MIFAB, Inc.
   b. Josam Company
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Anit-siphon wall faucet for mild climate area.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: 1/2" NPS or 1/2" NPS threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011, equal to WOODFORD Model 34HF.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Operating key.
15. Include two operating keys with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Moderate-Climate Wall Hydrants, HB-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide WOODFORD Model B75 or a comparable product by one of the following:

   a. MIFAB, Inc.
   b. Josam Company
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Anti-siphon wall hydrants for mild climate area.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: 3/4" NPS.
6. Outlet: Concealed, with integral vacuum; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Chrome Plated (CH).
9. Nozzle and Wall-Plate Finish: Chrome Plated (CH).
10. Vacuum Breaker: Integral or field-installation, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011, equal to WOODFORD Model 34HF.
11. Operating Keys(s): Provide two with each wall hydrant.

B. Freezeless Wall Hydrants, HB-5:

1. Basis-of-Design Product: Subject to compliance with requirements, provide WOODFORD Model B67 or a comparable product by one of the following:

a. MIFAB, Inc.
b. Josam Company
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Automatic draining freezeless wall hydrants with hose connection backflow protection. ASSE 1052 approved.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: 3/4" NPS.
6. Outlet: Concealed, with backflow preventer; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Chrome Plated (CH).
9. Nozzle and Wall-Plate Finish: Chrome Plated (CH).
10. Operating Keys(s): Provide two with each wall hydrant.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: 3/4" NPS.
4. Body: Copper alloy.

5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: 3/4" NPS.
4. Body: ASTM B 62 bronze.
5. Inlet: 3/4" NPS threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.12 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: 1/2" NPS minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: 1/2" NPS minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.13 TRAP-SEAL PRIMER VALVES

A. Trap Primer Valve and Distribution:

1. Manufacturers: Subject to compliance with requirements, provide trap primer valve PPP Model P1-500 with check valve seal, vacuum breaker port, and distribution unit PPP Model DU-4/DU-U. Provide fixed air gap fitting PPP Model AG-500 downstream of the trap primer valve and before the distribution unit. Or provide comparable products by one of the following:

   a. MIFAB, Inc.
   b. Sioux Chief Manufacturing Company, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Operating range: 20 psig to 80 psig.
4. Activating Pressure: 10 psig
5. Body: Bronze.
6. Inlet and Outlet Connections: 1/2" NPS threaded, union, or solder joint.
7. Distribution Number Outlets: Four.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, and pump.

H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

I. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install shutoff valve on outlet if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

J. Install water hammer arresters in water piping according to PDI-WH 201.

K. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

L. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

M. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

N. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

O. Locate water hammer arresters and trap-seal primer valves for easy access. If easy access is not available, install metal access panel. Coordinate access panel with architect.

P. Backflow preventer assemblies shall be installed in an accessible location with minimum of 1 foot of clearance shall be provided between the lowest portion of the assembly and grade or platform.

Q. Backflow preventers and other types of backflow preventers with an atmospheric discharge port (e.g., backflow preventer with intermediate atmospheric vent) are installed in floodprone areas, the lowest point of the atmospheric discharge port's opening should be installed at least 2-feet above the highest flood level which may have occurred in 10-yease period, but in no case less that 2-feet above grade.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Carbonated-beverage-machine backflow preventers.
5. Dual-check-valve backflow preventers.
6. Water pressure-reducing valves.
7. Calibrated balancing valves.
8. Primary, thermostatic, water mixing valves.
9. Manifold, thermostatic, water-mixing-valve assemblies.
10. Water tempering valves.
11. Outlet boxes.
12. Hose stations.
13. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check backflow preventers according to authorities having jurisdiction and the device's reference standard.

B. Backflow Prevention Devices shall be tested in accordance with ASSE Series 5000, USC'S FCCO & HR's "Manual of Cross-Connection Control", or UFL's TREEO's "Backflow Prevention – Theory and Practice".

C. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 1123

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

B. Related Sections include the following:

1. Division 22 Section "Domestic-Water Packaged Booster Pumps" for booster systems.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.5 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

C. Comply with NSF 61 and ANSI 372 for potable domestic water piping and components.

D. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 "Reduction of Lead in Drinking Water Act."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide TACO Cartridge Circulator Series or a comparable product by one of the following:

1. Bell & Gossett Domestic Pump; ITT Corporation.
2. Grundfos Pumps Corp.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Bronze, with threaded or sweat connections, or stainless steel, with flange connections.
3. Impeller: Non-Metallic.
4. Motor: Single speed, unless otherwise indicated.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. 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.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.3 CONTROLS

A. Thermostats: Electric, adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F, minimum.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.
7. Settings: Start pump when return temperature reaches 10 deg F lower than heater set point and stop pump when return temperature is within 5 deg F of the heater set point.

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day digital clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1.suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Programmable Sequence of Operation: Programming clock face and LCD readout screen allows for a maximum of 10 on-off setting. Run time intervals as short as1 minute.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft(s) horizontal.

D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.

E. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

F. Install pressure switches in water supply piping.

G. Install thermostats in hot-water return piping.

H. Install timers on wall near pump.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

   a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
   b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
   c. Vertically mounted, in-line, close-coupled centrifugal pumps.
   d. Comply with requirements for flexible connectors specified in Division 22 Section "Domestic Water Piping."

2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves

same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."

3. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

D. Comply with Division 26 Sections for electrical connections, and wiring methods.

E. Connect pressure switches, thermostats, time-delay relays, and timers to pumps that they control.

F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set pressure switches, thermostats, timers, and time-delay relays for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.6 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1. Division 22 Section "Chemical Waste-Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. PVC: Polyvinyl chloride plastic.

D. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Sanitary Sewer, Force-Main Piping: 50 psig.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. All cast iron soil pipe and fitting shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277/CISPI310 assembly of 301 Stainless Steel metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop Torque to 60 inch pounds.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310/ASTM C-1277, with 301 Stainless-Steel corrugated shield; stainless-steel bands and tightening devices torque to 60 inch pounds; and ASTM C 564, rubber sleeve.

C. Heavy-Duty, Shielded, Stainless-Steel Couplings: ASTM C-1540 With 304 Stainless-Steel shield, stainless-steel bands and tightening devices torque to 80 inch pounds, and ASTM C 564, rubber sleeve.
   1. 1-1/2" through 4" diameter couplings shall consist of a 3" wide corrugated 304 Stainless Steel shield in conjunction with four Stainless Steel clamps and elastomeric gasket. Torque coupling to 80 inch pounds
   2. 5" through 10" diameter couplings shall consist of a 4" wide corrugated 304 Stainless Steel Shield in conjunction with six Stainless Steel clamps and elastomeric gasket. Torque couplings to 80 inch pounds.

2.4 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

2.5 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

   1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
   2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
   3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Cellular-Core, Sewer and Drain Series, PVC Pipe: ASTM F 891, Series PS 100.

1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.

D. Solvent Cement and Adhesive Primer:

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Center-Sleeve Material: Manufacturer's standard.
2. Gasket Material: Natural or synthetic rubber.
3. Metal Component Finish: Corrosion-resistant coating or material.

E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.

F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.8 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-minimum thickness.

B. Form: Tube.

C. Color: Black.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping shall be one of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Aboveground, vent piping shall be one of the following:

1. Hubless cast-iron soil pipe and fittings; for buildings three floors and less use standard, shielded, stainless-steel couplings; and hubless-coupling joints. For buildings three floors or more use heavy-duty shielded, stainless-steel coupling; and hubless-coupling joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints, except in ceilings being used as return air plenums.
3. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Underground, soil, waste, and vent piping shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.

E. Where the temperature in the sanitary waste piping reaches 140 degrees or above, cast iron soil piping shall be installed.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Install underground, ductile-iron, force-main piping, special pipe fittings according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow

more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground and PVC soil and waste drainage piping according to ASTM D 2321.

N. Condensate-Drain Piping and Sump Pump Discharged Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

O. Condensate-Drain Piping and Sump Pump Discharged Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.]
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. For under the first level slab on grade, hang piping from slab using a minimum of 1/4" stainless steel rod wrapped around the pipe with ends bent into the slab by at least 4” on each end.

J. Support hub and spigot cast iron soil pipe every 5 feet horizontally for 5 foot lengths of pipe and 10 feet for 10 foot lengths, near every riser, elbow, tee and wye.

K. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

L. Install supports for vertical stainless-steel piping every 10 feet.

M. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

N. Install supports for vertical copper tubing every 10 feet.

O. Install hangers for [ABS] [and] [PVC] piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

P. Install supports for vertical [ABS] [and] [PVC] piping every 48 inches.

Q. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.

Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22 1319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Sanitary Floor Sinks
6. Roof flashing assemblies.
7. Through-penetration firestop assemblies.
8. Miscellaneous sanitary drainage piping specialties.
9. Flashing materials.
10. Interceptors

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
2. Division 22 Section "Plumbing Fixtures" for hair interceptors.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

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.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

D. Floor drains, area drains, adjustable floor drains, and trench drains shall comply with ASME A112.3-2001.

E. Grease interceptor with flow rated 100 gpm or less shall comply with ASME A222.18.1-2005.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Standard: ASME A112.14.1.
2. Size: Same as connected piping.
3. Body: Cast iron.
4. Cover: Cast iron with bolted or threaded access check valve.
5. End Connections: Hub and spigot or hubless.
6. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
7. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Size: Same as floor drain outlet.
2. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
3. Check Valve: Removable ball float.
4. Inlet: Threaded.
5. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Floor Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam Series 58630 or a comparable product by one of the following:

   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Floor type cleanout with white metal square frame and non-skid hinged cover locked or bolted on, with service-waste coated cast iron clean-out, Charlotte Part No. SV228 or equal, and coated cast iron plug.

B. Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam Series 58640-CO or a comparable product by one of the following:

   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Same as floor cleanout except with cleanout cover flush with a white metal access frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains, FD:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam Series 3000-S with square strainer for floors with square complements construction or square floor finish. Provide Josam Series 3000-A with round strainer for floors with no finish, equipment drains, and mechanical rooms or a comparable product by one of the following:

a. MIFAB, Inc.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Floor drain with two piece body, double drainage flange, invertible non-puncturing flashing collar, weepholes, adjustable satin Nikaloy round strainer, bottom outlet with no-hub drain for above ground floor installation and hub outlet for slab on grade installation.

B. Stainless-Steel Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam Series 30000-A-SS or a comparable product by one of the following:

a. MIFAB, Inc.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Type 304 cast stainless steel floor drain, two-piece body with double drainage flange, flashing collar, weepholes, vandal resistance, and adjustable round strainer. Provide waterproof shower pan with integrated curb and stainless steel drain plate.

2.4 TRENCH DRAINS

A. Trench Drains, TD:

1. Basis-of-Design Product: Subject to compliance with requirements, provide MIFAB model T2000 or a comparable product by one of the following:

a. Josam.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: 12 inch wide and 39.40” long polypropylene trench drain. Body is manufactured from polypropylene and each body has six tab for #5 rebar tie down and leveling. Provide with 4” outlet no hub connections. A heavy duty angle iron frame is supplied with galvanized steel grate options with lockdown hardware to secure to body. Provide with starting end cap.

2.5 SANITARY FLOOR SINKS

A. Floor Sink, FS:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Josam Series 49300-NB or a comparable product by one of the following:

a. MIFAB, Inc.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Description: Square cast iron, minimum 8” deep with acid resisting interior finish, double drainage flange with weepholes, aluminum internal dome strainer, Nikaloy sanitary sloped rim and Nikaloy anti-tilting grate with minimum free area of 33 square inches. Provide with round funnel for indirect waste discharge. Provide bottom outlet with no-hub drain for above ground floor installation and hub outlet for slab on grade installation

2.6 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

B. Size: Same as connected waste piping. With Extended Rim:

1. Description: Floor Drain with Adjustable satin finish nikaloy round strainer with extended rim, threaded with adjustable strainer thread.
2. Size: Same as connected waste piping.

C. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

   a. NPS 2: 4-inch-minimum water seal.
   b. NPS 2-1/2 and Larger: 5-inch minimum water seal.

D. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS ½ side inlet.

E. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

F. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

G. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

I. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

J. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.9 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. thickness.
2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.10 INTERCEPTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Lint Interceptor:

1. Description: Top access on floor trap type with acid resistant epoxy coating 10 gauge steel lint interceptor with flow rate of 80 gpm. Units shall include3” connections, gasketed non-skid cast iron cover, with ½” thick removable primary straining baffle with 3/8” (9) holes, and secondary ½” thick removable straing baffle with 3/8” (9) holes.

2. Basis-of-Design Product: Provide MIFAB Lint 3 or comparable products by one of the manufactures above.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Anchor grease interceptors to concrete bases.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 3 and smaller, 75 feet for piping NPS 4 through NPS 6, and 100 feet for piping NPS 8 and larger.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

I. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

J. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

K. Assemble open drain fittings and install with top of hub 2 inches above floor.

L. Install deep-seal traps on floor drains and other waste outlets, if indicated.

M. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

N. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

O. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

P. Install vent caps on each vent pipe passing through roof.

Q. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

S. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

T. Install wood-blocking reinforcement for wall-mounting-type specialties.

U. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

V. Install floor sink, hub drains, and open site drains with rim minimum of one inch higher than the surrounding floor. For floor sink and open site drain, gently slope floor finish to the drain rim as shown on the installation detail.

W. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

X. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

Y. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.

D. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Grease interceptors.

2. Oil interceptors.
3. Solids interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 22 1623

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service monitoring meters.
7. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa).

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Service meters. Indicate pressure ratings and capacities. Include bypass fittings.
5. Dielectric fittings.

B. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

D. Welding certificates.

E. Field quality-control reports.

F. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect and Construction Manager no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Architect's or Construction Manager's written permission.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
c. Lapped Face: Not permitted underground.
d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
c. Aboveground Portion: PE transition fitting.
d. Outlet shall be threaded or flanged or suitable for welded connection.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
b. Outlet shall be threaded or flanged or suitable for welded connection.
c. Bridging sleeve over mechanical coupling.
d. Factory-connected anode.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Lyall, R. W. & Company, Inc.
2) Mueller Co.; Gas Products Div.
3) Perfection Corporation; a subsidiary of American Meter Company.

b. PE body with molded-in, stainless-steel support ring.
c. Buna-nitrile seals.
d. Acetal collets.
e. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following::

1) Lyall, R. W. & Company, Inc.
2) Mueller Co.; Gas Products Div.
3) Perfection Corporation; a subsidiary of American Meter Company.

b. Fiber-reinforced plastic body.
c. PE body tube.
d. Buna-nitrile seals.
e. Acetal collets.
f. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Stainless-steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Stainless-steel bolts, washers, and nuts.
e. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.

5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm).

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).

2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig (862 kPa).
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig (862 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flowserve.
b. Homestead Valve; a division of Olson Technologies, Inc.
c. McDonald, A. Y. Mfg. Co.
d. Milliken Valve Company.
e. Mueller Co.; Gas Products Div.
f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Kerotest Manufacturing Corp.
b. Lyall, R. W. & Company, Inc.
c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: PE.
3. Ball: PE.

4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig (552 kPa).
8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Actaris.
   b. American Meter Company.
   c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   d. Invensys.
   e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Eclipse Combustion, Inc.
    d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    e. Invensys.
    f. Maxitrol Company.
    g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 2 psig (13.8 kPa)

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 1 psig (6.9 kPa).

2.6 SERVICE MONITORING METERS

A. Turbine Meters: Comply with ASME MFC-4M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Meter Company.
   b. Invensys.
   c. Sensus.

2. Housing: Cast iron or welded steel.
3. Connection Threads or Flanges: Steel.
4. Turbine: Aluminum or plastic.
5. Turbine Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet.
8. Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig (690 kPa).
11. Accuracy: Maximum plus or minus 2.0 percent.

2.7 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   d. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a

description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 24 inches (600 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 24 inches (600 mm) below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed in ceiling return air plenum and under the

building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings not being used as return air plenum: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel flat.
d. Color: yellow.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex flat.
d. Color: yellow.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be one the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES 0.5 PSIG (3.45 kPa) AND LESS THAN 5 PSIG (34.5 kPa)

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.14 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. PE valves.
2. NPS 2 (DN 50) and Smaller: Bronze plug valves.
3. NPS 2-1/2 (DN 65) and Larger: Cast-iron, lubricated plug valves.

3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

E. Valves in branch piping for single appliance shall be the following:

1. One-piece, bronze ball valve with bronze trim.

2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION

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SECTION 22 3400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

C. Product Certificates: For each type of commercial, gas-fired domestic-water heater, from manufacturer.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

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.

B. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

E. ANSI 372 for potable domestic water piping and components.

F. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 “Reduction of Lead in Drinking Water Act.”

G. Louisiana Boiler Inspection Law Compliance RS 23:536: Boiler shall conform with the provisions of the Louisiana Boiler Inspection Law in accordance with the adopted rules and regulations.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty shall cover Five (5) years on parts and labor from the date of Substantial Completion:

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Condensing, Gas-Fired, Storage, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide PVI Industries Conquest Condensing Water Heater Series or comparable product by one of the following:

   a. Lochinvar Corporation.
   b. Rheem Manufacturing Company.
   c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Water heaters will be of BTU inputs and storage capacity indicated on the equipment schedule.
4. Water heater shall meet the thermal efficiency and standby heat loss requirements of ASHRAE90.1-2010.
5. Water heater shall be a vertical fire tube or water tube design that is constructed and stamped in accordance with Section IV, Part HLW of the ASME code. Water heater shall be Nation Board Registered for a working pressure of 150 psi and shall be pressure tested at 1-1/2 times working pressure.
6. Water heater shall be a fire tube or water tube design contained within an integral storage tank.
7. Water heater Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

8. Water heater shall be certified for indoor installation.

9. Factory-Installed Storage-Tank Appurtenances:

   a. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   b. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   c. Jacket: Steel with enameled finish or polyethylene jacket (consisting of 100% recycled material).
   d. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel. Combustion will be provided by a premix, fan-assisted

surface burner with a gas train meeting UL, ANSI and FM standards for the input specified.

e. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
f. Burner NOx emissions will be less than 20 ppm when corrected to 3% oxygen.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: Compliant with Louisiana State Plumbing Code 2013 and ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

10. Water heater will be a category IV, condensing appliance and vent through PVC or Polypropylene. Water heater will satisfy requirements for sealed combustion. Vents for inlet air and exhaust can terminate in different pressure zones.
11. Operating and safety controls shall meet the requirements of UL 795 and FM.
12. Water heater shall employ an electronic operating control with digital temperature readout.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ELBI DTL Series or a comparable product by one of the following:

   a. Watts Water Technologies, Inc.
   b. Wessels Company.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

3. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: 2 gal. Minimum.
c. Air Precharge Pressure: 40 psi.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than 3/4" with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters shall be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23 Section "Facility Natural-Gas Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain. Combination temperature-and pressure relief valve shall be compliant with Louisiana State Plumbing Code, 2013.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

E. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

F. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each

domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

H. Fill domestic-water heaters with water.

I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Division 22 Section "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 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.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 22 4000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories, showers, and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Lavatories.
8. Individual showers.
9. Service basins.
10. Electric water coolers.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 31 Section "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

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.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Comply with ANSI 372 for potable domestic water piping and components.

G. Comply with Louisiana House Bill No. 471 (2011); Act No. 362 “Reduction of Lead in Drinking Water Act.”

H. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

I. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Bathtub and Shower Units: ANSI Z124.1.2-2005.
3. Plastic Sinks: ANSI Z124.6.
4. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
5. Slip-Resistant Bathing Surfaces: ASTM F 462.
6. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
7. Stainless-Steel Residential Sinks: ASME A112.19.3.
8. Ceramic, Vitreous-China Fixtures: ASME A112.19.2M.
9. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
10. Water-Closet, Flushometer Tank Trim: ASSE 1037.

J. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

K. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.

4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

L. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

M. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Grab Bars: ASTM F 446.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Hot-Water Dispensers: ASSE 1023 and UL 499.
8. Off-Floor Fixture Supports: ASME A112.6.1M.
9. Pipe Threads: ASME B1.20.1.
10. Plastic Shower Receptors: ANSI Z124.2.
11. Plastic Toilet Seats: ANSI Z124.5.
12. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Electronic Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago Faucets model 116.211.AB.1 or a comparable product by one of the following:

   a. American Standard Companies, Inc.
   b. Delta Faucet Company.
   c. Kohler Co.

2. Description: ADA compliance, sensor operated faucet set with above deck hermetically sealed electronic and water-tight solenoid with filter-screen. Low battery indicator. 6 V lithium CRP2 battery included. Mounting hardware included.

   a. Body Material: solid brass.
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: 0.5 gpm.
   d. Centers: Single hole.
   e. Mounting: Deck.
   f. Valve Handle(s): Not applicable.
   g. Inlet(s): 3/8” compression thread connections with stainless steel braided hoses.
   h. Spout: Rigid type.
   i. Spout Outlet: 0.5 gpm vandal resistant spray outlet.
   j. Operation: Sensor.
   k. Drain: Grid.
   l. Tempering Devices: TM-1, Concealed internal temperature control mixer and mixing valve that conforms to ASSE 1070.

3. Self-closing metered faucets, including sensor operated faucet, used for lavatories and other hand washing fixtures shall provide a flow of water for min. of 15 seconds without the need to be reactivated.

2.2 SHOWER FAUCETS

A. ADA Shower Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard Valve Company model 4500 515P or a comparable product by one of the following:

   a. Acorn Engineering Company.
   b. Bradley Corporation
   c. Delta Faucet Company.

2. Description: ADA compliance shower faucets with vandal resistant single-handle pressure-balance valve. Include hot- and cold-water indicators; check stops; and hand shower, 24" slide bar, and flange. Coordinate faucet inlets with supplies.

   a. Hand Shower: Leonard Valve Company model 515P 60" Flexible hose, chrome plated brass supply arm, 24" slide bar, double check valve backflow preventer and 1.5 flow control. Hand shower meet ANSI A112.18.1M Flow requirements.

   b. Shower valve: Leonard Valve Company model 4500 pressure balancing valve, comply with ASSE 1016 and ASME A112.18.1. Shall be stainless steel balancing piston, built in shut-off for single handle operation, internal parts of bronze and stainless, cast wall flange and ADA compliant lever handle with polished chrome plated finish, adjustable high temperature limit stop (set 110° F), color coded dial with directional indicators, plasterguard/thin wall mounting bracket, and minimum flow of 1.5 gpm.

2.3 SINK FAUCETS

A. Double Compartment Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay model LKE4101 or a comparable product by one of the following:

   a. T & S Brass and Bronze Works, Inc.
   b. Zurn Plumbing Products Group.
   c. American Standard Companies, Inc.
   d. Delta Faucet Company
   e. Kohler Co.
   f. Chicago Faucet

2. Description: ADA compliance kitchen faucet with retractable spray. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

   a. Body Material: solid brass.

b. Finish: chrome plate.
c. Maximum Flow Rate: 2.5 gpm.
d. Mixing Valve: Single lever handle.
e. Centers: 8 inches.
f. Mounting: Deck.
g. Handle(s): Wrist blade, 4 inches.
h. Inlet(s): 1/2" NPSM coupling nut for 3/8” or 1/2" flexible riser.
i. Spout Type: Swing, cast brass.
j. Spout Outlet: Vandal resistant aerator.
k. Operation: Noncompression, manual.
l. Drain: Elkay model LK99.

2.4 FLUSHOMETERS

A. Water Closet Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan model Optima System 8100 or a comparable product by one of the following:

   a. Delany Products.
   b. Zurn.

2. Description: ADA compliance, flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, vandal resistant stop cap, polished chrome-plated finish on exposed parts, and low battery indicator light.

   a. Internal Design: Diaphragm operation.
   b. Style: Exposed.
   c. Inlet Size: 1” IPS.
   d. Trip Mechanism: Battery-operated sensor actuator with mechanical override push button.
   e. Consumption: 1.6 gal./flush.
   f. Tailpiece Size: 1-1/2” NPS and standard length to top of bowl.

2.5 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Centoco model 1500STSCCSS or a comparable product by one of the following:

   a. Church Seats
   b. Bemis Manufacturing Co.

2. Description: Toilet seat for water-closet-type fixture.

    a. Material: Molded, solid plastic with antimicrobial agent.
    b. Configuration: Open front without cover.
    c. Size: Elongated.
    d. Hinge Type: Self-sustaining, check, stainless steel.
    e. Class: Heavy-duty commercial.
    f. Color: White.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Engineered Brass Co.
    b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
    c. McGuire Manufacturing Co., Inc.
    d. Plumberex Specialty Products Inc.
    e. TCI Products.
    f. TRUEBRO, Inc.
    g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements

2.7 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Zurn Plumbing Products Group; Specification Drainage Operation.

3. MIFAB Manufacturing Inc
4. Smith, Jay R. Mfg. Co.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.

B. Lavatory Supports:

1. Description: Lavatory, floor mount, concealed arms with minimum 4" X 3" floor support block bases; steel hangers; adjustable supporting arms and ½" bolts and anchors.

2. Basis-of-Design Product: Provide Smith, Jay R. Mfg. Co. model 0700 for single and Smith, Jay R. Mfg. Co. model 0700D for back-to-back or comparable products by one of the manufactures above.

C. Electrical Water Cooler Supports:

1. Description: Electrical Water Cooler Supports, floor mount, with concealed hanger and round steel uprights with floor support welded bases.

2. Basis-of-Design Product: Provide Smith, Jay R. Mfg. Co. model 0800 for single electrical wall mounted water cooler and Smith, Jay R. Mfg. Co. model 0834R or 0834L for two electrical wall mounted water coolers or comparable products by one of the manufactures above.

D. Heavy Duty Sink Supports:

1. Description: Sink supports, floor mount, heavy duty with minimum 4 1/2" X 3" floor support block base; steel rectangular structural uprights; steel hanger plate, adjustable supporting and bearing studs; and 1/2" bolts and anchors.

2. Basis-of-Design Product: Provide Josam Series 17380-HD or comparable products by one of the manufactures above.

2.8 WATER CLOSETS

A. ADA Water Closets, WC-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan model ST-2029-A Universal closet or a comparable product by one of the following:

   a. Crane Plumbing, L.L.C./Fiat Products
   b. Kohler Co.
   c. Zurn Plumbing Products Group; Specification Drainage Operation.
   d. American Standard

2. Description: ADA compliance, Floor-mounted, vitreous-china fixture designed for flushometer valve operation.

a. Style: Flushometer valve.

1) Bowl Type: Elongated with siphon-jet design with 1-1/2" top spud. Include chromium plated mounting nuts and washers, and vandal-proof trim.
2) Design Consumption: 1.28 gal./flush.
3) Color: White.

b. Flushometer: As specified.
c. Height: Mount 17" above finish floor.
d. Toilet Seat: As specified.
e. Fixture Support: As specified.

2.9 LAVATORIES

A. Lavatories, L-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan model SS-3003 series or a comparable product by one of the following:

a. Crane Plumbing, L.L.C./Fiat Products
b. Kohler Co.
c. Zurn Plumbing Products Group; Specification Drainage Operation.
d. American Standard

2. Description: ADA compliance, wall-mounting, with electric faucet vitreous-china fixture.

a. Type: Wall-hung lavatory with rear overflow.
b. Size: 20.75" by 18.25" rectangular.
c. Faucet Hole Punching: single hole
d. Color: White.
e. Faucet: As specified.
f. Supplies: 3/8" NPS chrome-plated copper with stops.
g. Drain: Grid.
h. Drain Piping: 1-1/4" NPS chrome-plated, cast-brass P-trap with cleanout; 1-1/4" NPS, thick tubular brass waste to wall; and wall escutcheon.
i. Fixture Support: As specified with 4" cover plate.
j. Protective Shielding Guard(s): As specified.

2.10 COMMERCIAL SINKS

A. Double Compartment Sinks, F-4B:

1. Basis-of-Design Product: Subject to compliance with requirements, provide equal to Elkay LRAD25055 model or a comparable product by one of the following:

a. Just
b. Kohler Co.
c. Sterling Plumbing Group, Inc

2. Description: Two compartments, counter-mounting, 304 stainless steel, 20-gauge, ledge type, self-rimming, and fully coated underside to reduce sound and condensation.

a. Overall Dimensions: 33”x22”.

b. Faucet Hole Punching: 4 holes.

c. Each Compartment:

1) Drains: Type 304 stainless steel body, removable 3-1/2” basket strainer, rubber stopper, and chrome plated brass 1-1/2” tailpiece.

a) Location: Centered in compartment.

d. Drainboard(s): Not required.

e. Faucet: As specified.

f. Supplies: 1/2" NPS chrome-plated copper with stops or shutoff valves.
g. Drain Piping: Drain Piping: 1-1/2” NPS chrome-plated, cast-brass P-trap with cleanout; 0.045-inch thick tubular brass waste to wall; continuous waste; and wall escutcheon(s).

2.11 INDIVIDUAL SHOWERS

A. ADA Individual Showers, SH-1:

1. Basis-of-Design Product: Comfort Designs 6232TR .75 L-BAR, Gelcoat Base model XST6232TR .75

a. Package Options:

1. PB – Pressure Balancing.
2. TP – Tamper Proof Grate Option.
3. CLS – ComfortCare 1.25 Stainless
4. CVS – 24” ComfortCare Stainless
5. HD – HDPE White
6. CRS – Curtain rod/cups Stainless Steel
7. CVW – Vinyl weighted white
8. HH – Hand held shower assembly with slide bar, vacuum breaker and 60” hose

2. Description: Factory-fabricated acrylic shower with shower curtain rod. Verify size, model, and color with architect.

a. Shower Faucet: As specified.
b. Drain: Grid, NPS 2.

2.12 ELECTRIC WATER COOLER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Elkay Manufacturing Co.
2. Haws Corporation.
3. Halsey Taylor.
4. Oasis Corporation.

B. Double Electric Water Cooler, EWC-1:

1. Description: ADA compliant, self-contained, vandal-resistant pressure water cooler that that shall deliver 8 gph of 50°F drinking water at 90°F ambient and 80°F inlet water. Unit shall be constructed of 14 gauge stainless steel with integral basin. Venting shall include protective screening. Front vandal-resistant push button activation with less than 5 lbs of force. Water-efficient, vandal-resistant bubbler shall be one-piece and operate on 20-105 psi supply line pressure. Shall include front access stream height adjustment. Cooling system shall included insulated stainless steel evaporator tank, R134a refrigerant and calibrated capillary tube for refrigerant control. Shall include adjustable, accessible thermostat. Shall comply with ANSI 117:1 and American with Disabilities Act for both children and adult frontal approach. The manufacturer shall certify the unit to meet the requirements of NSF/ANSI 61, Safe Drinking Water Act and be UL Listed.

2. Basis-of-Design Product: Halsey Taylor model OVL-II Bi-Level ADA or comparable products by one of the manufactures above.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.

R. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

S. For noncommercial type dishwasher, connect inlet hose to dishwasher and outlet hose to connect through a wye connection into the tail piece of a sink with flexible hose looped up to within 2” of the bottom of the counter top..

T. Install bubbler in right front of top surface of sink.

U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

V. Set shower receptors and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

W. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Lavatories, hand washing fixtures, noncommercial dishwasher, clothes washer, bathtub, showers, and whirlpools shall be limited to maximum domestic hot water temperature of 120°F.

D. The temperature of the water delivered from public use lavatories or hand washing fixtures shall be limited to a maximum temperature of 120°F by a temperature control device that conforms to ASSE 1070.

E. The temperature of the water delivered from bathtubs and whirlpools shall be limited to a maximum temperature of 120°F by a temperature control device that conforms to ASSE 1070.

F. The temperature of the water delivered from individual shower and shower/bath combinations shall be limit to a maximum temperature setting of 120°F by automatic compensating scald preventative valve of the pressure balance, thermostatic, or combination pressure balance/thermostatic mixing valve type for scald and thermal shock protection that’s conform to ASSE 1016, ASME A 112.18.1 or CSA B125.1., which shall be field adjusted in accordance with the manufacturer’s instructions.

G. Replace washers and seals of leaking and dripping faucets and stops.

H. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 0100

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Sections apply specified in this section.

B. Separation of Division 23 into Sections is for convenience only and is not intended to establish limits of work. Sections are as follows:

1. 230100 Basic Mechanical Requirements
2. 230513 Common Motor Requirements for HVAC Equipment
3. 230517 Sleeves and Sleeve Seals for HVAC Piping
4. 230518 Escutcheons for HVAC Piping
5. 230529 Hangers and Supports for HVAC Piping and Equipment
6. 230548 Vibration Controls for HVAC
7. 230593 Testing, Adjusting, and Balancing for HVAC
8. 230700 HVAC Insulation
9. 232300 Refrigerant Piping
10. 233113 Metal Ducts
11. 233300 Air Duct Accessories
12. 233423 HVAC Power Ventilators
13. 233522 Straight Rail Vehicle Exhaust Removal System
14. 233713 Diffusers, Registers, and Grilles
15. 238126 Split-System Air-Conditioners
16. 238128 Ductless Split System Air Conditioners

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations and expands the requirements specified in Division 1. These requirements are: Contractor's Qualifications, Quality Assurance, Reference Codes and Standards, Permits and Inspections, Equipment and Materials, Examination of Premises, Submittals, Coordination Drawings, Record Documents, Project Closeout, Warranty, Measurements, Operation Prior to Substantial Completion, Contractor Operation Prior to Substantial Completion, Electrical Work, Painting, Protection of Equipment and Work, Rough-ins, Mechanical Installations, and Cutting and Patching.

B. Related Sections:

1. Division 01 Section “Submittal Procedures”

1.3 DEFINITIONS

A. The following definitions apply to all Division 23 specification sections:

1. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
2. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
3. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
4. Installer: The term "Installer" is defined as the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. Installers shall be skilled in the work they are to perform.
5. Specialist: The term "Specialist" means an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workmen skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the contract specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.
6. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
7. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
8. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
9. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
10. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SCOPE

A. The following requirements apply to the work necessary to provide (additions and supplements to existing) plumbing system and air conditioning system or systems, as specified in the various sections of this Division.

1.5 CONTRACTOR'S QUALIFICATIONS

A. An acceptable contractor for the work under this Division shall be a specialist in this field and have the personal experience, training and skill and the organization to provide a practical working system. If required, he shall be able to furnish acceptable evidence of having contracted for and installed not less than 3 systems of comparable size and type to this one, that have served their owners satisfactorily for not less than 3 years. The foreman for this work shall have had experience in installing not less than 3 such systems and shall be approved before work is begun.

B. Work under this Division shall only be accomplished by entities licensed under provision of Section 2163, of the Rules and Regulations of the State of Louisiana Contractors License Law, R.S. 37:2150-2164.

1.6 QUALITY ASSURANCE

A. Manufacturers:

1. Trade names, manufacturers and catalog numbers are mentioned herein and on the Drawings solely in order to establish a standard for the type, general design and quality of product required. Other products similar in design, of equal quality and complying with the Drawings and Specifications will be considered after the contract is let only for those items with which the expression "or approved equal" is used. Where two or more manufacturers or materials are named, the Contractor may submit any of those named, provided they conform to the Specification. Identification in the project documents of any product by name, manufacturer or model number does not include either expressed or implied warranty of unqualified product acceptance. All products must be capable of proper installation in the spaces provided, readily maintained and must satisfy other requirements contained in the contract documents.
2. If manufacturer and/or model number is indicated in the Contract Documents, it is for the purpose of identifying the product that is the “Basis of Design”. This means the product has been used as the basis for coordination for all architectural, structural, electrical, & mechanical requirements. If a manufacturer and/or model number other than the one named is procured, the Contractor shall be responsible for all changes necessary including additional design services incurred by the Owner to allow the installation of the selected product. It shall be the Owner's sole discretion to determine if additional design assistance is needed. Owner shall be compensated by the Contractor for the cost of the additional service to the Architect and/or Engineer to change

the design and/or review the equipment placement changes elected to be made by the Contractor.

1.7 REFERENCE CODES AND STANDARDS

A. Requirements set forth in reference codes and standards are minimum for equipment, material and work. In instances where capacities, size, etc., of equipment, devices or materials listed in the Contract Documents exceed these minimums, listed or shown capacities, etc. shall prevail.

B. Comply with applicable laws, ordinances, codes and rules, with latest revisions adopted, of the following governing codes and agencies:

1. International Mechanical Code
2. International Building Code
3. Sanitary Code of the State of Louisiana
4. Fire Marshal of the State of Louisiana
5. Louisiana Standard Plumbing Code, 2000 Edition

C. Industry standards and specifications issued by the following organizations shall apply to materials and workmanship:

1. AMCA Air Moving and Conditioning Association
2. ASME American Society of Mechanical Engineers
3. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
4. ETL Engineering Testing Laboratory
5. NEMA National Electrical Manufacturers' Association
6. NFPA National Fire Protection Association
7. SMACNA Sheet Metal and Air Conditioning Contractors' National Association
8. UL Underwriters' Laboratories, Inc.

D. Local laws and codes take precedence over state laws and codes, which, in turn, take precedence over national codes and industry standards.

E. Comply with the rules and regulations of the "Safety Code for Mechanical Refrigeration", (ANSI/ASHRAE 15-2007). Meet the requirements of the ASME Unfired Pressure Vessel Code. All pressure vessels shall be stamped "ASME" and "National Board". Furnish to the Owner for each pressure vessel supplied under this Specification, a manufacturer's data report for unfired pressure vessels, Form U-I, as required by the ASME Code Rules.

F. This form must be signed by a qualified inspector holding a National Board Commission, certifying that construction conforms to the latest ASME Code for Unfired Pressure Vessels. The ASME symbol "U" also shall be stamped on each vessel.

1.8 PERMITS AND INSPECTIONS

A. Permits and Fees: Obtain and pay for all permits. Pay fees and all other payments required by utility regulatory bodies in connection with the Work. Pay for all inspections required under local codes with regard to the Work.

B. Certificates of Inspection: Upon completion of the work, furnish certificates of inspection from all inspection or regulatory agencies having jurisdiction over work of Division 23.

1.9 EQUIPMENT AND MATERIALS

A. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. The plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

B. The label of the approving agency, such as UL, AGA, ASME, ARI, AMCA, by which a standard has been established for the particular item, shall be in full view.

C. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be the manufacturer's latest design.

D. Deliver equipment and materials to the site and store in original containers, suitably sheltered from physical damage and the elements, but readily accessible for inspection. Equipment damaged in shipment will not be acceptable.

1.10 EXAMINATION OF PREMISES

A. Visit the site of the proposed work before bidding. Inspect the site and become familiar with the difficulties and restrictions attending the execution of the contract.

B. No additional compensation will be allowed for failure to be informed of site conditions.

1.11 SUBMITTALS

A. General:

1. Submit for review shop drawings, product data and samples. Comply with requirements of Division 1 Section "Submittals". Minimum number of copies shall be four (4). Mark each individual item with pertinent specification section and paragraph number. Submittal will be rejected if specification and paragraph number under which it is being submitted is not identified.

2. If the submittal deviates from the requirements of the Contract Documents, the deviation shall be identified in writing on the first page of the submittal. Identify where within the Contract Documents the deviation occurs. The deviation shall only be considered acceptable if the identified deviation has been initialed by the Engineer. Any deviation not initialed may be assumed to be rejected. All coordination required due to the deviation, such as space allocation, changes to electrical service, or any other required changes shall be born as Work of Division 23 but accomplished by Installers skilled in the Work being performed. No costs incurred by the approved deviation shall be born by the Owner.
3. Review of shop drawings and submittals does not relieve the Contractor of responsibility for compliance with the specific requirements of the Contract Documents, or for fitting the equipment in the space allotted, with proper space for connection of piping or ductwork and for servicing or for coordination of the work with work of other trades. Approval of deviations also does not relieve the Contractor of responsibility for compliance with all other aspects of the Contract Documents.
4. Review is for general conformance with the design concept of the project and general compliance with the information given in the project documents. Responsibility for confirming and correlating all quantities and dimensions, selecting fabrication processes and establishing techniques of construction resides with Contractor. Review subcontractors' submittals and shop drawings and indicate by rubber stamp or letter that they have been reviewed and approved before forwarding them. Submittals and Drawings will be returned after review indicating whether or not exceptions are taken and the required procedure to be followed thereafter. Revised and acceptable submittals and shop drawings are required before construction is begun. Include dimensional data and weights of equipment. Include motor manufacturers' names.
5. In general, the Architect and/or his consultants will review each submittal as indicated above. If submittal does not comply with the Contract Documents as indicated by the submittal being marked "REJECTED" and "RESUBMIT", be responsible to the Owner for any additional costs the Owner incurs due to review of follow-on submittals.

B. Samples:

1. Submission of samples may be required by the Architect, particularly where equipment is visible in finished areas. Arrange demonstrations of a product's ability to perform as specified if required. Include dimensional data and weights of equipment. Include motor manufacturers' names.

C. Shop Drawings:

1. Shop drawings shall consist of plans, sections, elevations and details to scale (no smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other Divisions and shall show space allotted for it. Include

construction details and materials. As a minimum, submit shop drawings covering equipment rooms, equipment foundations, equipment supports, ductwork, field-fabricated equipment, piping or any other drawings specifically called for in this and other Sections. Include the following:

a. Controls and instrumentation, including complete electrical interlock.
b. Built-up equipment.
c. Equipment rooms (any room in which there is Division 23 equipment)
d. Equipment housekeeping pads, and vibration isolation.
e. Field-fabricated hangers, supports, guides and anchors.
f. Piping & Ductwork Layouts.

D. The drawings show existing construction components and systems as on record by the Owner. As part of the shop drawing process, field verifies location and size of structural members, location of partitions, and existing systems shown. If field measurements differ from the information on the drawings which causes a conflict in the Work, promptly consult the Architect for resolution. The Owner shall not be responsible for any delays in construction due to the Contractor failing to field verify information shown on the drawings as existing.

E. Product Data:

1. Submit product data within 45 days after award of the Contract and before any equipment or materials are purchased. Product data is defined as manufacturers' printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp "No exception taken" on submittal is required before ordering equipment unless otherwise noted.
2. Submit items identified in the individual Sections. If product data have not been received within 45 days after award of the Contract, only the manufacturer named shall be allowed e.g. if "American Standard or approved equal" is stated in the Contract Documents, after 45 days only the American Standard product shall be allowed, or if the scheduled equipment on the drawings indicates "Loren-Cook" for fans, after 45 days only Loren-Cook products shall be allowed.

1.12 COORDINATION DRAWINGS

A. Prepare and submit a complete set of Construction Coordination Drawings utilizing the dimensions of the actual equipment to be utilized and indicating the exact routing for all elements such as piping, cable tray, conduit, ductwork, fire sprinkler lines, etc., including conduit embedded in concrete, and paying close attention to sloped plumbing lines such as sanitary and storm sewer. Use the architectural and structural drawings as the base drawings to which all trades shall add their work.

Provide Plan Views as well as sufficient Elevations and Sections to assure and demonstrate installation sequencing, access, and space coordination upon review.

Complete each Coordination Drawing and include on the drawing sign-off by each individual trade performing work in the affected area, as well as the Contractor. No work shall commence in the area covered by the specific drawing until review and acceptance of drawing. This requirement for Coordination Drawings is not authorization for the Contractor or individual trades to make any unauthorized changes to the Contract Drawings. Maintain all Design Drawing space allocations such as ceiling heights (maintaining an eight (8) inch high zone directly above the ceiling for flexibility), chase wall dimensions, equipment room sizes, etc., unless prior written authorization is received from the Architect to deviate.

Work installed by a trade which interferes with work of any other trade will be corrected at no cost to the Owner.

The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions reviewed by the Engineer, or for deviations from requirements in the Contract Documents. Understand clearly that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

B. Indicate the proposed locations of piping, ductwork, equipment, and materials and include vertical measurement from floor to bottom of piping, ductwork, and elevated equipment. Piping drawings shall include access panel locations, valves, sleeves, location of supports, etc. Ductwork drawings shall include access panel locations (in duct and building construction to obtain entry to service and maintain duct mounted equipment), vanes, scoops, splitters, dampers, grilles, diffusers, coils, etc. Vertical measurement shall be indicated at all changes in direction of piping and ductwork. Measurement shall be made to the outside surface of exterior insulated ducting and piping. Measurements shall include clearances for installing and maintaining insulation; servicing and maintaining equipment; space for equipment disassembly for periodic maintenance; and showing areas for tube, filter, and coil removal. Provide details of connections and supports, exterior wall and foundation penetrations, sizes and locations of concrete housekeeping pads, and indicate space for valve stem movement. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Include location of sleeves in floors, walls, and ceilings. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication system components, sprinklers, smoke detectors, and other ceiling mounted items.

D. Provide digital copies of final coordination drawings, separated by trade, to the owner in dwg and/or pdf file formats.

E. Mechanical ductwork priority over all other systems being installed (MEP) above ceiling. Rerouting of installed systems due to uncoordinated drawings is the responsibility of the general contractor.

1.13 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Project Closeout". As a minimum, record documents shall show ductwork; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair; piping systems with valves and control devices located and numbered according to tags; concealed unions and items requiring maintenance such as traps, strainers, expansion compensators, expansion and compression tanks. Locate all access panels installed to maintain mechanical equipment. Reference prominent building lines when showing dimensions of equipment, pipe, ducting, and access panels. Identify installations different from the original plans due to product substitutions, Contract Modifications, and actual equipment and material installed. All elements underground shall be shown giving actual inverts and horizontal locations. Engage the services of a Land Surveyor or Professional Engineer registered in the State in which the project is located to record locations and invert elevations of underground installations. Complete this survey work prior to the covering of the underground installation.

B. Provide digital copies of final record documents, separated by trade, to the owner in dwg and/or pdf file formats.

1.14 PROJECT CLOSEOUT

A. Mark and otherwise correct a set of reproducible drawings to reflect the final location of all work installed under Division 23, to serve as record documents, in accordance with Division 1 Section "Project Closeout". Locate cleanouts, valves, traps, manual and automatic dampers, fire and smoke dampers, control sensing elements in ducts, and other concealed items requiring adjustment or maintenance. Supplement with additional sketches on tracing paper for clarification, if necessary. Certify in writing that record drawings have been checked and are accurate. Submittal of these documents is a prerequisite for certification of substantial completion. Contractor may obtain a set of reproducible drawings from the Architect and shall pay for them.

B. Conform to other requirements included in Division 1 Section, "Project Closeout".

1.15 WARRANTY

A. Refer to applicable paragraph under GENERAL CONDITIONS. Warrant all materials and workmanship for a period of five years. Repair or replace promptly defects due to faulty materials, methods of installation or workmanship, with the least inconvenience and without expense to the Owner and at time designated by the Architect within the five-year period. Additional specific performance or extended time warranties called for in the individual sections under this Division must be provided.

B. The warranty period for mechanical work shall commence on the date certified by the architect or engineer that the contract is substantially complete in accordance with the plans and specifications, or upon beneficial use by the Owner, whichever occurs first. When beneficial use is for only a portion of the work, the warranty shall commence only on that portion of the work.

1.16 MEASUREMENTS

A. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Study carefully the sizes and locations of structural members, wall and partition locations, attic spaces, ceiling furring, chase spaces and room dimensions and take actual measurements on the job. Locate ductwork, piping, equipment and accessories, with sufficient space for installing, insulating and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment, piping or ductwork can not be fitted, the Architect shall be consulted. All equipment, apparatus and materials must fit into the available, designated spaces, with proper clearances for maintenance, service and repair.

1.17 OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Owner shall have the right to operate systems and equipment prior to substantial completion, as soon as tested and operational, provided all safety devices have been installed. Agreement between Owner and Contractor relative to time and hours of operation and responsibility for start up and shutdown is required. Do not permit operation which may damage equipment or cause damage to the building or to the work of other contractors. Air filters must be in place on air conditioning units and strainers must be in place in all piping systems prior to operation.

1.18 CONTRACTOR OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Obtain written authorization from the Owner for Contractor's use of equipment. If equipment is allowed to be used during construction period, all start-up

requirements for the equipment shall be adhered to prior to operation including start-up procedures, required equipment check-out by factory authorized representatives, required equipment inspection reports, and commissioning as required in the individual Sections. A copy of operating and maintenance manuals shall be kept on-site while equipment is in operation. These manuals shall be made available to Owner's maintenance crews if Contractor is off-site and equipment is still in operation. In addition, no sooner than seven days prior to Substantial Completion being granted, original equipment check-out by factory authorized representative, required equipment inspection reports, and commissioning shall be completed a second time. Equipment or components found not in compliance with the Contract Documents shall be replaced without cost to the Owner. Submit by letter to the Owner the date in which each piece of equipment is put into operation.

B. Maintain duct cleanliness during air handling equipment use by installing minimum 30% filter material over all return and exhaust openings. If duct cleanliness is found by the Architect to be unacceptable, duct shall be cleaned with alcohol impregnated pad and pad changed as it loads with dirt. Provide additional access panels within the ductwork allowing cleaning to be completed. Added access panels required for this remedial cleaning shall be provided at no cost to the Owner.

1.19 ELECTRICAL WORK

A. General:

1. Electrical service shall be as indicated on the Drawings. All power wiring and all circuit breakers, starters, disconnect switches, pilot lights, hand-off-automatic (H-O-A) switches, pushbutton stations, except such items which are provided as part of "packaged" mechanical equipment or specifically noted herein, shall be furnished, set in operating position, and electrically connected as work of DIVISION 26, ELECTRICAL.

2. Should the Contractor desire to use equipment requiring larger motors or electrical characteristics differing from those shown, it is the responsibility of work requirements under Division 23 to inform other affected parties of the proposed changes to permit them to supply proper wiring, disconnects and starters. Additional costs incurred to work of other Divisions caused by such changes shall be borne as work of Division 23. Coordination to establish areas of possible change between Division 23 work and work of another Division shall occur prior to equipment delivery from the manufacturer.

B. Starters: Motor starters furnished with mechanical equipment covered by this section shall conform to the requirements of Division 26. Provide motor overload protection requirements for sizing overload protection device for motor starters furnished under Division 26.

C. Conduit and Wiring: As work of Division 23, all interlock conduit and wiring and control conduit and wiring shall be provided, and all control elements shall be set in

position and connected. Electrical wiring for firestats or smoke detectors which interrupt line voltage power circuits to motors and for wall-mounted thermostats which interrupts line voltage power circuits to motors and interlock from smoke detectors for the shutdown of motors shall be work of Division 23. Provide control transformers and additional relays required for interface with the electrical system. Unless indicated otherwise, power wiring and conduit for all devices shall be work of Division 26.

1.20 PAINTING

A. Painting shall be done under Section 09900, except for touch-up of factory finishes on equipment located inside and outside. Obtain matched color coatings from the manufacturer and apply as directed. Prime coating of certain equipment is specified under individual equipment specification. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint in accordance with requirements of Section 09900.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT AND WORK

A. Continuously maintain adequate protection of stored materials and installed work. Tightly cover fixtures and equipment, with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust and moisture. Provide heat to equipment being stored to prevent condensation. Do not store materials and equipment outside, directly on the ground, or in areas where it may be subject to physical injury from vehicular traffic or construction machinery. Ductwork, piping and equipment installed under this Division shall not be used by other trades as supports for scaffolds or personnel. Do not deliver controls or other delicate equipment to the job site unless they can be placed in protected areas. At work completion, clean equipment, fixtures, exposed ductwork and piping, including hangers and supports to the Architect's satisfaction.

3.2 ROUGH-IN

A. Verify the final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to equipment specifications in Divisions 2 through 28 for rough-in requirements.

3.3 MECHANICAL INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components during progress of construction to allow for mechanical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence and coordinate installation of large pieces of equipment prior to closing in the building.

B. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect with a suggested resolution. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building components, where installed exposed. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components without requiring the removal of permanent construction or disabling the function of a required fire-resistance-rated assembly. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location external to the piece of equipment. Install access panel or doors where equipment is concealed behind finished surfaces. See Division 8 Section "Access Doors" and Division 23 Section for related basic mechanical materials and methods.

E. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope. In general, ductwork shall take precedence over piping. Set system elevations to minimize offsets where systems cross. Make full use of all three dimensions and stack ductwork, equipment, and accessories vertically as required. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "Cutting and Patching". Engage experienced Installers in cutting and patching this work.

Installers' qualifications refer to the materials and methods required for the surface and building components being patched. See Division 1 Section "Definitions and Standards" for definition of "experienced Installer". Protect adjacent installations during all cutting and patching operations.

B. Perform cutting, fitting, and patching for mechanical equipment and material installation. Uncover work to provide for installation of ill-timed work. Remove and replace defective mechanical work and work not conforming to requirements of the Contract Documents. Install equipment and materials in existing structures. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.

C. Upon written instructions from the Architect, uncover and restore work to provide for Architect observation of concealed work covered prior to inspection. Uncovering and restoring work required to be observed by the Architect prior to covering as identified in the Contract Documents will be at no cost to the Owner.

D. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items as identified in the Contract Documents. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers.

END OF SECTION

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

B. Related Sections:

1. Division 01 Section “Submittal Procedures”

1.3 COORDINATION

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 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 23 0517

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

B. Related Sections:

1. Division 01 Section “Submittal Procedures”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

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SECTION 23 0518

ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

B. Related Sections:

1. Division 01 Section "Submittal Procedures"

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, partitions, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
   f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
   g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.

2. Escutcheons for Existing Piping:

   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

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SECTION 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Division 01 Section “Submittal Procedures”
2. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports
3. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
4. Division 23 Section "Vibration Controls for HVAC Piping and Equipment" for vibration isolation devices.
5. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Metallic Coating: Hot-dipped galvanized.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig] minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F,pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION

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SECTION 23 0548

VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. General: This Section includes vibration control devices, materials, and related items for use in isolating vibrations caused by rotating and reciprocating equipment specified here or in other Division 23 Sections. All rotating and reciprocating equipment shall be provided with vibration isolators as part of the manufactured equipment or as required under this Section.

B. Related Sections

1. Division 01 Section "Submittal Procedures"

C. Vibration isolation devices and materials included under this Section are:

Isolator	Description
Type 1	Ribbed Neoprene Pad
Type 2	Neoprene-In-Shear Mounts
Type 2H	Neoprene-In-Shear Hanger
Type 3	Open Spring
Type 3H	Combination Spring and Neoprene-In-Shear Hanger
Type 4	Restrained Spring
Type 5	Thrust Restraint
Type A Base	Directly Bolted Attachment
Type B Base	Structural Bases or Rails
Type C Base	Concrete Inertia Base
Type D Base	Curb Isolation

1.3 REFERENCES

A. ASHRAE Handbook "Applications", 2007, Chapter 47, "Sound and Vibration Control."

B. American Society of Testing and Materials (ASTM):

1. A123–89ae1, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
2. A153-95, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
3. A384–76(1991), "Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies"
4. A780-93a, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings"

1.4 SYSTEM DESCRIPTION

A. Design Requirements: All equipment provided under Division 23 Specification Sections with manufacturer installed isolation elements shall be reviewed for proper installation in the locations shown. Manufacturer shall certify in writing factory provided isolation elements satisfy the requirements of this Section for isolator type and minimum deflection identified.

B. For all equipment containing motors, rotating elements, or reciprocating elements without manufacturer designed and installed vibration isolation, provide the isolators specified under this Section. Examine the Contract Documents for sizes, horsepower, rotational speeds, equipment location, length of span between columns and beams, and construction type. From previously approved equipment submittals and/or from equipment Suppliers obtain equipment weights, support points, weight per support point, rotating speeds, sound power levels and equipment configurations. Based upon this information, select the appropriate isolator size and proper loading to meet the specified deflections.

C. Performance Requirements: Select isolators to meet the equipment vibration criteria for human occupancy referenced in Table 48 of 2007 ASHRAE Applications Handbook, Chapter 47.

1.5 SUBMITTALS

A. General: Provide submittals in accordance with the Conditions of the Contract, Division 1 Section "Submittals," and Section 230100 "Basic Mechanical Requirements". Section 230100 contains general requirements for Product Data and Shop Drawing submittals. In addition, submit the following:

1. Product Data: Specific isolators being used as identified in Part 2.
2. Shop Drawings: Identify location and type of all vibration isolators. Provide a complete tabulation showing for each vibration isolator (a) the design load, (b) the static deflection expected under the design load, (c) specified minimum static deflection, (d) the additional deflection to solid under design load, and (e) the ratio of spring height under design load to spring diameter. For vibration isolated roof mounted equipment, include the calculations and deflections on the isolators due to wind loading. For steel rails, steel base frames, and concrete inertia bases show all steel work, reinforcing, vibration

isolator mounting attachment method, and weight being supported at each attachment point. Provide special details at large scale and all other necessary information to convey complete understanding of the work to be performed. Location of vibration isolation equipment bases, pipe hangers, duct hangers and flexible connections shall be coordinated with and clearly shown on the submitted equipment room, pipe, and duct shop drawings. Failure to show the above isolators may result in rejection of the shop drawings.

3. Samples: Submit samples of each type of vibration isolation device without cost to the Owner.
4. Manufacturer's Certification: Isolator manufacturer shall certify by letter that the selections of vibration isolation equipment are based on the Contract Documents and approved equipment submittals, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that the appropriate isolator size has been selected to meet the specified deflections.
5. Contractor's Certification: Provide a Contractor signed certificate that the submittal prepared by the manufacturer has been reviewed and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation. For roof mounted vibration isolated equipment, certificate shall specifically indicate the isolation system has been reviewed for Code required wind loading on equipment as well as other loading.
6. Galvanizer Certification: At the time of isolator shipment, submit certified statement by the galvanizer indicating conformity of the galvanizing with the ASTM Standards for all isolators located out-of-doors or in an expected wet environment such as basements or other areas, especially those below ground level.
7. Completion Report: At completion of the installation, submit a report certifying each piece of operative mechanical equipment does not exceed the specified vibration displacement level. Include results of testing identified in Part 3.

1.6 QUALITY ASSURANCE

A. Isolators shall be selected by a vibration isolator equipment specialist. Provide products of the same manufacturer for each isolator Type.

B. Provide all incidental equipment and materials needed to meet the requirements of the specification. Should any rotating equipment cause noise or vibration exceeding the manufacturer's specifications, rebalance, realign or complete other remedial work required to reduce noise and vibration levels.

C. Make all adjustments as directed by the Architect resulting from his inspection. Final acceptance of vibration isolation systems is dependent on completion of all adjustments and remedial work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver vibration isolation equipment in manufacturer's original shipping containers. Store indoors and protect from entrance of construction dirt and debris into the containers. Vibration isolation equipment and bases which show signs of rust, cement or concrete fouling, or accumulation of dirt shall be disassembled and cleaned to the satisfaction of the Architect. If cleaning does not result in restoring the vibration isolation equipment and bases to like new condition, in the opinion of the Architect, remove from the project site and replace with new.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate installation of vibration isolation equipment and bases with mechanical equipment, piping, and ducting installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are:

1. Amber/Booth Co., Houston, TX
2. Korfund Dynamics Corp., Westburn, NY
3. Mason Industries, Inc., Hollis, NY
4. Peabody Noise Control, Inc., Dublin, OH
5. Vibration Mountings & Controls, Inc., Butler, NJ

2.2 VIBRATION ISOLATOR TYPES

A. General: All metal parts of vibration isolation units installed out-of-doors or in an expected wet environment such as basements or other areas, especially those below ground level, shall be hot-dip galvanized after fabrication. Galvanizing shall comply with ASTM A123, A153, and A384 as applicable.

1. Type 1, Ribbed Neoprene Pad: Neoprene pad isolators shall be formed by two layers of 5/16" to 3/8" thick ribbed or waffled neoprene, separated by a stainless steel plate. These layers shall be permanently glued together. Neoprene shall be 40 to 50 durometer. Size pads so they will be loaded between 40 and 50 psi.
2. Type 2, Neoprene-In-Shear Mounts: Double deflection neoprene mounts shall have a minimum static deflection of 0.35". Metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom. Bolt holes shall be provided for bolting as required.
3. Type 2H, Neoprene-In-Shear Hanger: Hanger shall have neoprene-in-compression element and metal frame with attachments for top and bottom suspension rods. Metal hanger housing shall be galvanized and factory painted.

Hanger housing lower hole size shall be large enough to permit the lower rod to swing through a 30° arc before contacting the housing.

4. Type 3, Open Spring: Spring isolators shall be free-standing and laterally stable without any housing. Spring diameter shall not be less than 80% of the compressed height of the spring at the design load. Springs shall have a minimum additional travel to solid equal to 50% of the actual deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1.0. All mounts shall have leveling bolts. Each isolator shall have a ribbed or waffled neoprene friction pad permanently adhered to the bottom. A rectangular bearing plate shall be provided of sufficient size to load the friction pad uniformly in the range of 40 to 50 psi.
5. Type 3H, Combination Spring and Neoprene-In-Shear Hanger: Hanger shall contain a laterally stable steel spring and a neoprene element in series. Provide a neoprene neck bushing where the hanger rod passes through the hanger housing to prevent metal to metal contact. Metal hanger housing shall be galvanized and factory painted. Spring diameters and hanger housing lower hole sizes shall be large enough to permit the lower rod to swing through a 30° arc before contacting the housing. Spring elements shall have a minimum additional travel to solid equal to 50% of the actual deflection. The neoprene element shall be designed to have a minimum 0.3" static deflection. Include with the Submittal a scale drawing of the hanger showing the 30° capability.
    a. For pre-compressed hangers, characteristics shall be as described above, but they shall be pre-compressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. Design hangers to include a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale marked in minimum ¼" segments.
6. Type 4, Restrained Spring: Provide a Type 3 spring but also provide housing to limit vertical travel to prevent spring extension when weight is removed. Housing shall serve as blocking during erection of equipment and shall be located between the equipment supporting steel and roof, grillage, housekeeping pad, or dunnage. Installed and operating heights shall be the same. Housing shall provide a minimum ½" clearance around restraining bolts and spring so there is no interference with the spring action. Limit stops shall be out of contact during normal operations.
7. Type 5, Thrust Restraint: Horizontal thrust restraint shall consist of spring element in series with a neoprene pad as described for Type 3H isolator above. Provide same deflection as specified for mountings or hangers. Spring element shall be contained within the steel housing and designed to be preset for thrust at the factory and adjusted in the field to allow a maximum of ¼" movement at start and stop of equipment. Provide assembly with two rods and angle brackets for attachment to both equipment and ductwork or the equipment and the structure. Attach horizontal restraints at the centerline of the thrust and symmetrically on either side of the unit.
8. Type A Base, Directly Bolted Attachment: No supplementary base is required. Vibration isolators shall be attached directly to the supported equipment or structural system.

9. Type B Base, Structural Bases or Rails: Construct bases or rails of mill rolled structural sections of sufficient dimensions to limit the midpoint deflection or unsupported spans to 1/1440th of the span between isolators. When designing structural sections, include equipment static loading, power transmission, component misalignment, and cantilever loading. Coordinate design of structural rails and isolators to reduce mounting heights when head room is limited. Factory finish with two coats of equipment enamel with each coat drying to a 4 mil film thickness.
10. Type C Base, Concrete Inertia Base: Provide concrete inertia base as shown on the drawings. As an alternate, construct base perimeter of structural steel channels with steel reinforcing cast in a stone aggregate concrete (150 lbs/ft^3) as designed and supplied by the vibration isolator supplier. Build base to form a rigid structure to preclude twisting, cracking, deforming, or deflecting in any manner which would negatively affect the operation of the supported equipment or the vibration isolation mounts. Inertia base shall be adequately sized to support basic equipment and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements or other components closely related and requiring resilient support in order to prevent vibration transfer to building structure. Inertia base thickness shall be not less than 6". Inertia bases shall include side mounting brackets or embedded side housings for attachment to vibration isolators. Side housings shall be structurally secured to the steel members.
11. Type D Base, Curb Isolation: Provide vibration isolation bases that fit over the roof curb and under the isolated equipment. Provide extruded aluminum top member overlapping the bottom member to provide water runoff independent of the seal. Aluminum members shall house cadmium plated springs having minimum 1" deflection with 50% additional travel to solid. Spring diameters shall be no less than 80% of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of ¼" so as not to interfere with the spring action except in high winds. Weather seal shall consist of continuous closed cell sponge materials both above and below the base. Provide a waterproof flexible duct-like EPDM connection joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: Refer to Part 2 - Products of this specification for vibration isolation devices identified on the drawings or specified herein.

1. Major Equipment: As a minimum, provide vibration isolation for major mechanical equipment items as listed in ASHRAE Applications Handbook, 2007, Chapter 47, Table 48. Types and static deflections of vibration isolation devices for major equipment items shall be as given in the above referenced

Table 42 using floor span matching building. Slab on grade requirements apply to equipment in basements. Unless otherwise shown or specified, all floor mounted major equipment shall be set on 4" high housekeeping type concrete pads. Pads shall be a minimum 3" larger on each side than unit dimensions. Install Type 1 isolators under all equipment assemblies internally isolated by the manufacturer unless shown or specified otherwise.

2. Performance: Isolation shall be stable during starting and stopping of equipment without any transverse or eccentric movement that could damage or adversely affect the equipment or attachments. Maximum lateral motion allowed for isolation systems for floor, ceiling, or roof mounted equipment under start up and shut down is ¼". Correct motion in excess of ¼" by installing restrained spring-type mounts (Type 4). Select isolators for lowest operating speed of isolated equipment and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
3. Pipe Isolation: Isolate all piping 1 ½" in diameter and larger which is connected to rotating or reciprocating equipment in mechanical rooms or within 50' of horizontal pipe length from the connected equipment, whichever is longer. The first three pipe hangers shall provide the same deflection as the connected isolated equipment, with a maximum limit of 2" deflection; the remaining hangers shall be Type 3H with 0.75" deflection. Provide resilient pipe guides and sleeves/seals for piping requiring isolation outside mechanical rooms as it passes through partition walls, floors, or roofs. Install flexible pipe connections specified under Section 230516 on the suction and discharge of all base mounted pumps and on the supply and return piping to all coils.

3.2 INSTALLATION

A. General: Locations of all vibration isolation equipment shall be selected for ease of inspection and adjustments as well as for proper operation. Install vibration isolation equipment in conformance with the manufacturer's published recommendations and as indicated below. Unless specified otherwise, securely bolt isolators to equipment, steel bases, or concrete inertia bases. Type 1 isolators under equipment shall not be bolted to equipment.

1. Floor/Roof Mounts: All vibration isolators shall be aligned squarely beneath mounting points of the supported equipment and upon the concrete housekeeping pads. If a housekeeping pad is provided, install isolators entirely on the pad. The installed and operating height of equipment mounted on Type 4 isolators shall be identical. Limit stops shall be out of contact during normal operation.
2. Hangers: Position vibration isolation hanger elements as high as possible in the hanger rod assembly, and so the hanger housing may rotate a full 360 degrees without contacting any object. Install all pre-compressed spring hangers on individual piping systems prior to activating the release mechanism.
   a. At the Contractor's option, hang parallel running pipes on a trapeze which has isolators, as required, in each hanger rod. Equipment or pipe hanging from other piping is prohibited. Resiliently isolated piping shall not contact any rigid building structure or equipment.

3. Bases: No isolated equipment shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether a base frame is called for in the schedule or not. In the case that a base frame is required for the equipment and not specifically called for on the major equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
   a. Unless otherwise indicated, provide a minimum 1 ½" operating clearance between the inertia base or structural steel frame and the concrete housekeeping pad or floor beneath the equipment. Position isolator mounting brackets so the required clearance is maintained. Check the clearance space after installation and prior to final acceptance to ensure construction debris or other items are not present that may short circuit or restrict the proper operation of the vibration isolation systems.
4. Thrust Restraints: Install thrust restraints (Type 5) for all fan heads, suspended fans, and base-mounted and suspended air handling equipment operating at 2" of total static pressure and above.
5. Resilient Penetration Sleeves/Seals: Install penetration seals to maintain an airtight seal around the penetrating element and to prevent rigid contact between the penetrating element and the building structure.

3.3 GALVANIZED ISOLATORS

A. Prior to installation of vibration isolation equipment requiring galvanized coating, inspect factory applied coating for damage during shipping or areas not coated at factory. Repair zinc coating according to procedures in ASTM A780. After installation, inspect installed galvanized vibration isolation equipment for damage to coating during installation. Repair zinc coating according to procedures in ASTM A780.

3.4 ADJUSTING

A. Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the isolator manufacturer.

3.5 TESTS AND REPORTS

A. Testing: Each vibration isolation device shall be deflection tested. The report shall include the tabulated data submitted under the Shop Drawings and, include the actual installed additional travel to solid distance and installed base clearance above housekeeping pads or floors.

B. Reports: Two copies of a bound report shall be submitted and approved by the Architect prior to final acceptance.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

B. Related Section:

1. Division 01 Section “Submittal Procedures”

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.

B. TAB Conference: Meet with Architect, Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. 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.

1.7 COORDINATION

A. Notice: Provide seven 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, TAB contractors shall be certified by either:

1. AABC, or
2. NEBB.

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 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

Ducts" 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 terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. 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. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. 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 AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

   1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. 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, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. 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.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

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 Ducts."

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.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. 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.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. 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.
7. 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, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain 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.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain 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.
5. Refrigerant suction pressure and temperature.

3.10 TOLERANCES

A. Set HVAC system's air 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.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend

changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

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. 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. Report date.
6. Signature of TAB supervisor who certifies the report.
7. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
8. 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.

9. Nomenclature sheets for each item of equipment.
10. Data for terminal units, including manufacturer's name, type, size, and fittings.
11. 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. Settings for supply-air, static-pressure controller.
    e. Other system operating conditions that affect performance.

C. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Make and type.
c. Model number and unit size.
d. Sheave make, size in inches, and bore.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Outdoor airflow in cfm.
f. Return airflow in cfm.

D. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.

E. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

F. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.

d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft..
    g. Indicated air flow rate in cfm.
    h. Indicated velocity in fpm.
    i. Actual air flow rate in cfm.
    j. Actual average velocity in fpm.
    k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary air flow rate as needed in cfm.
    d. Preliminary velocity as needed in fpm.
    e. Final air flow rate in cfm.
    f. Final velocity in fpm.
    g. Space temperature in deg F.

J. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.
    b. Serial number.
    c. Application.

d. Dates of use.
e. Dates of calibration.

3.13 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 10 percent of air outlets.
   b. Measure water flow of at least 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 Architect and Commissioning Authority].
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Construction Manager and Commissioning Authority.
3. Architect and Commissioning Authority 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 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 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.

END OF SECTION

SECTION 23 0700

HVAC INSULATION

PART - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

   a. Cellular glass
   b. Flexible elastomeric.
   c. Mineral fiber.
   d. Phenolic.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.
13. Pipe Wrap/Lagging Material

B. Related Sections:

1. Division 01 Section "Submittal Procedures."
2. Division 21 Section "Fire-Suppression Systems Insulation
3. Division 22 Section "Plumbing Insulation."
4. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Board Insulation: ASTM C 552, Type IV.
4. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

J. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.

K. Mineral-Fiber, Preformed Pipe Insulation:

L. Phenolic:

1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
4. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Preformed Pipe Insulation: ASJ.
    b. Board for Duct and Plenum Applications: ASJ.
    c. Board for Equipment Applications: ASJ.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a [1] [2]-hour fire rating by a NRTL acceptable to authority having jurisdiction.

2.3 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Insulco, Division of MFS, Inc.; Triple I.
   b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Insulco, Division of MFS, Inc.; SmoothKote.
   b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
   c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, and Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products, Division of ITW; CP-96.
   b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. 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).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.
    c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    d. RBX Corporation; Rubatex Contact Adhesive.

2. 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).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-82.
    b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    d. Marathon Industries, Inc.; 225.
    e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. 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.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-82.
    b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    d. Marathon Industries, Inc.; 225.
    e. Mon-Eco Industries, Inc.; 22-25.

2. 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).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

2. Dow Chemical Company (The); 739, Dow Silicone.
   a. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   b. P.I.C. Plastics, Inc.; Welding Adhesive.
   c. Speedline Corporation; Speedline Vinyl Adhesive.

3. 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).

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      a. Childers Products, Division of ITW; CP-35.
      b. Foster Products Corporation, H. B. Fuller Company; 30-90.
      c. ITW TACC, Division of Illinois Tool Works; CB-50.
      d. Marathon Industries, Inc.; 590.
      e. Mon-Eco Industries, Inc.; 55-40.
      f. Vimasco Corporation; 749.

   2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
   5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      a. Childers Products, Division of ITW; CP-10.
      b. Foster Products Corporation, H. B. Fuller Company; 35-00.
      c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
      d. Marathon Industries, Inc.; 550.

e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
4. Service Temperature Range: Minus 50 to plus 180 deg F.
5. Color: White.

2.7 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, and Phenolic Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. 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).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

2. Childers Products, Division of ITW; CP-76-8.
   a. Foster Products Corporation, H. B. Fuller Company; 95-44.
   b. Marathon Industries, Inc.; 405.
   c. Mon-Eco Industries, Inc.; 44-05.
   d. Vimasco Corporation; 750.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Fire- and water-resistant, flexible, elastomeric sealant.
5. Service Temperature Range: Minus 40 to plus 250 deg F.
6. Color: Aluminum.
7. 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).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. 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).

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

3. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

4. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. 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 is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

   a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size, contractor’s option.

b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. 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.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

2.12 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

2.13 ACOUSTIC PIPE LAGGING MATERIAL

A. Work Included:

1. Furnish all labor, materials, tools, and equipment for the installation of sound control lagging material as indicated per the following schedule.
2. Furnish and install pipe wrap/lagging material in accordance with manufacturer's instructions on all piping housing regularly-flowing liquid, that meet the following conditions.
   a. Located in a plenum above a classroom or core learning space.
   b. Located directly above the top of the finished ceiling of a classroom or core learning space.
   c. Located within a wall or partition directly adjacent to a classroom or core learning space.

B. System Description:

1. The sound control lagging material is applied continuously as part of the pipe and/or duct system to reduce sound transmission from the pipe or duct i.e., control breakout noise.
2. Material shall consist of a rugged, reinforced aluminized-faced, mass loaded limp vinyl barrier, 4.9-kg/m^2 (1-psf) bonded to a scrim-faced, quilted fiber glass absorber/decoupler. Material shall be non-lead composition for safe handling and easy installation.
3. Rolls of lagging shall include an additional 152-mm (6") width of barrier on one side to provide an overlap of adjacent application and an improved acoustical seal.

C. Quality Assurance

1. The sound control lagging material shall be produced by a manufacturer having a minimum of five years' experience in furnishing similar noise control lagging material for pipe and duct.

2. Submittals shall include test reports from independent laboratories meeting the following minimum criteria. Products not meeting these minimum test standards will not be accepted.

   a. Insertion Loss when tested as a duct wrap over 51-mm (2") fiber glass board (per ASTM E1222-90):

Frequency, Hz	125	250	500	1000	2000	4000	STC
KNM-100ALQ	2	10	16	27	35	34	33

   b. Insertion Loss when tested as a duct wrap directly over duct (ASTM E1222-90):

Frequency, Hz	125	250	500	1000	2000	4000	STC
KNM-100ALQ	3	6	7	18	24	27	28

   c. Sound Transmission Loss when tested as a free-hanging barrier (ASTM E90-90):

Frequency, Hz	125	250	500	1000	2000	4000	STC
KNM-100ALQ	13	16	24	33	43	49	28

D. Manufacturers

1. Basis of Design (BOD): Kinetics Noise Control, model KNM-100ALQ. 6300 Irelan Place, Dublin, OH 43017-0655. Telephone: 800-959-1229. Fax: 614-889-0540. E-mail: archsales@kineticsnoise.com.
2. Pinta acoustic, model PROSPEC Pipe Lagging.
3. American Acoustical Products, 1 lb./s.f. Insulwrap Lagging Material on 1" Insulwrap Quilt acoustic absorber.

E. Materials

1. The barrier shall be constructed of a 3-mm (0.12") thick mass loaded, limp vinyl sheet bonded to a thin layer of reinforced aluminum foil on one side. The barrier shall have a nominal density of 4.9-kg/m^2 (1.0-psf) and shall have a minimum STC rating of 27. The barrier shall exhibit minimum flammability ratings of 0.0-seconds for flame-out and after-glow, and 5-mm (0.2") for char length when tested in accordance with Federal Test Std. No. 191-5903. The barrier shall have a minimum thermal conductivity (K) value of 0.29 and a rated service temperature range of -40°C (-40°F) to 105°C (220°F). When tested for Surface Burning Characteristics per ASTM E84, the barrier will have a Flame Spread Index of no more than 10 and a Smoke Development Index of no more than 40.
2. The decoupling layer shall be a combination of 25-mm (1.0") fiber glass batting, non-woven porous scrim-coated glass cloth, quilted together in a

matrix of 100-mm (4.0”) diamond stitch pattern which encapsulates the glass fibers.

3. The composite material shall be fabricated to include a nominal 152-mm (6”) wide barrier overlap tab extending beyond the quilted fiber glass to facilitate a leak-tight seal around field joints. Nominal barrier width 1372-mm (54”), nominal fiber glass batt decoupler width 1219-mm (48”).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-

sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 ACOUSTIC PIPE LAGGING MATERIAL INSTALLATION

A. The correct installation of the sound control lagging material is critical in order to achieve the desired noise reduction. Sound control lagging material shall be cut to length, wrapped around the outside of the pipe or duct, and fastened with mechanical fasteners or bands. Tape and adhesive can be used in conjunction with mechanical fasteners or bands. All sound control lagging materials must be installed per the manufacturer’s installation guidelines.

3.6 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.7 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection and finish with mastic.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.8 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with strapping tape without deforming insulation materials.
2. Where vapor barriers are required, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure with self- seal laps or tape.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as

recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch. For chilled water piping, seal joints with joint sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.9 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with ASJ tape or self seal lap and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with ASJ tape, and vapor barrier mastic for systems that operate below ambient.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with ASJ tape.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, pins are not needed.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 4 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket and FSK tape, and mastic if needed at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

4. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for [100] [50] <Insert percentage> percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of

factory- or field-applied jacket and mastic as needed at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.11 PHENOLIC INSULATION INSTALLATION

A. General Installation Requirements:

1. Secure single-layer insulation with strapping tape or self seal lap jacket.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with strapping tape or self seal lap.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with strapping tape or self seal lap jacket.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with tape.
4. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and joint sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.12 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. 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.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. 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 aluminum bands 12 inches o.c. and at end joints.

3.13 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.14 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.15 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air.
2. Indoor, exposed supply air.
3. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
4. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Outside air ductwork supplied to the space at neutral conditions installed in a return air plenum.
2. Exhaust ductwork
3. Fibrous-glass ducts.
4. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
5. Factory-insulated flexible ducts.
6. Factory-insulated plenums and casings.
7. Flexible connectors.
8. Vibration-control devices.
9. Factory-insulated access panels and doors.

3.16 DUCT INSULATION SCHEDULE

A. Supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu.ft nominal density.

B. Outdoor-air duct (located in non-conditioned space) insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu.ft. nominal density.

C. Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating and zero clearance to combustibles.

3.17 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.18 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Flexible Elastomeric: 3/4" inch thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

    a. Flexible Elastomeric: 1 inch thick.

3.19 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Flexible Elastomeric, 1 inches thick.

3.20 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Concealed: ASJ Jacket.

C. Piping, Exposed: PVC: 20 mils thick.

3.21 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed: Aluminum, Stucco embossed: 0.016 inch thick.

END OF SECTION

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SECTION 23 2300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Filter dryers.
4. Strainers.
5. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and

pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L, ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
6. Pressure Rating: Factory test at minimum 400 psig.
7. Maximum Operating Temperature: 330 deg F.

F. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
2. End Connections:

   a. NPS 2 and Smaller: With threaded-end connections.
   b. NPS 2-1/2 and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.

4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24 or 115-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

F. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

G. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

H. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

I. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

J. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

K. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

L. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type K or L drawn-temper tubing and wrought-copper fittings with soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. NPS 5/8 and Smaller: Copper, Type ACR or L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 and Smaller: Copper, Type ACR, K, or L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2: Copper, Type ACR, K, or L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

   a. Fill system with nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
   d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

END OF SECTION

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall, longitudinal seam, round ducts and fittings.
4. Single-wall, spiral seam, round and flat oval duct and fittings.
5. Double-wall, spiral seam, round and flat-oval ducts and fittings.
6. Sheet metal materials.
7. Duct liner.
8. Sealants and gaskets.
9. Hangers and supports.

B. Related Sections:

1. Division 01 Section "Submittal Procedures".
2. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts
3. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers, partitions, and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

D. Welding certificates.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

F. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

G. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Traverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL, LONGITUDINAL SEAM, ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Tables 302 and 3-3 using G-60 coated galvanized steel complying with ASTM Ag53 and A924 grades of lock forming quality. Comply with all applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SINGLE-WALL, SPIRAL SEAM, ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: System shall be ASTM A653 & A924 G90 galvanized sheet steel with light guage, spiral lockseams. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL, SPIRAL SEAM, ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: System shall be ASTM A653 & A924 G90 galvanized sheet steel with light guage, spiral lockseams with interstitial fiberglass insulation installed between outer duct and perforated metal inner duct.. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated. Fabricate ducts with indicated dimensions for the inner duct.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity:

   a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches
3. Sealant: Modified styrene acrylic.
4. Water resistant.

5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Where ducts pass through smoke barriers, provide smoke dampers or combination fire/smoke dampers.

M. Where ducts pass through smoke partitions, provide smoke dampers on all transfer openings.

N. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven] days' advance notice for testing.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean existing duct systems before testing, adjusting, and balancing. Contractor shall be required to clean new duct systems if the IAQ management plan required for LEED EQ Credit 3.1 was not correctly implemented and dust and debris are clearly visable on interior portions of ductwork.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. General: All supply ductwork shown on drawings to be lined shall be double wall. All return, transfer ductwork shown on drawings to be lined shall be provided with standard liner specified in Section 23 “HVAC Insulation.” Medium pressure ductwork shall be spiral seam, round and flat oval ductwork (unless shown otherwise on drawings). Branch runouts ducts from low pressure main trunk duct shall be single wall, longitudinal seam.

B. Supply Ducts & Return Ducts:

1. Ducts Connected to Fan Coil Units, Single zone Air Handling Units, and Terminal Units (i.e. Low Pressure Ductwork):

   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Variable-Air-Volume Air-Handling Units & Dedicated Outdoor Air Systems (i.e. Medium Pressure Ductwork):

   a. Pressure Class: Positive 3-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

   a. Pressure Class: Negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Air-Handling Units:

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

   a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
   b. Concealed: Carbon Sheet Steel.
   c. Welded seams and joints.
   d. Pressure Class: Positive or negative 2-inch wg.
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   f. SMACNA Leakage Class: 3.

4. Ducts Connected to Dishwasher Hoods:

   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 finish.
   c. Concealed: No. 2D finish.

d. Welded seams
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

5. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seam.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

E. Liner:

1. Return, Transfer Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Supply Fan Plenums: Fibrous glass, Type II 2 inches thick with perforated inner metal wall.
3. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
4. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
5. Supply Ducts: Fibrous glass, Type I, 1 inch thick with perforated inner metal wall.

F. Double-Wall Duct Interstitial Insulation:

1. Supply & Return Air Ducts: 1 inch thick.

G. Elbow Configuration: Provide radius and mitered elbows as shown on drawings. Where radius elbows are shown, provide 1.5 radius to diameter ratio unless space constraints will not allow. If space constraints are an issue, use elbow sizes scheduled below.

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: 45-degree entry.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are not permitted.

    a. Low loss Tee & cross fittings with 45 degree entry.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Flexible ducts.
17. Duct accessory hardware.

B. Related Sections:

1. Division 01 Section "Submittal Procedures".
2. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps
3. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating

C. Comply with requirements of ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 2000 fpm.

C. Maximum System Pressure: 1-inch wg.

D. Frame: 0.063-inch- thick extruded aluminum, with welded corners and mounting flange.

E. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Vinyl foam.

H. Blade Axles:

1. Material: Non-metallic.
2. Diameter: 0.20 inch.

I. Tie Bars and Brackets: Aluminum.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

3. Screen Mounting: Rear mounted.
4. Screen Material: Galvanized steel.
5. Screen Type: Insect.
6. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Suitable for horizontal or vertical mounting.

B. Maximum Air Velocity: 2000 fpm.

C. Maximum System Pressure: 2-inch wg.

D. Frame: 0.063-inch- thick extruded aluminum, with welded corners and mounting flange.

E. Blades:

1. Multiple, 0.025-inch- thick, roll-formed aluminum.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

F. Blade Seals: Neoprene.

G. Blade Axles: Nonferrous metal.

H. Tie Bars and Brackets:

1. Material: Aluminum.
2. Rattle free with 90-degree stop.

I. Return Spring: Adjustable tension.

J. Bearings: Synthetic.

K. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames:

   a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.

5. Blade Axles: Nonferrous metal.
6. Bearings:

   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

A. Type: Static; rated and labeled according to UL 555 by an NRTL.

B. Closing rating in ducts up to 4-inch wg] static pressure class and minimum 4000-fpm velocity.

C. Fire Rating: 1-1/2 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.6 CEILING DAMPERS

A. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

B. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

C. Blades: Galvanized sheet steel with refractory insulation.

D. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

E. Fire Rating: 2 hours.

2.7 SMOKE DAMPERS

A. General Requirements: Label according to UL 555S by an NRTL.

B. Smoke Detector: Integral, factory wired for single-point connection. Coordinate communication interface with fire alarm system as per specification section 283111.

C. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

E. Leakage: Class I .

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application .

H. Damper Actuator: 120Vac, Two-position action, fail close with external mounting.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Type: Static; rated and labeled according to UL 555 and UL 555S by an NRTL.

B. Closing rating in ducts up to 4-inch wgstatic pressure class and minimum 4000-fpm velocity.

C. Fire Rating: 1-1/2 hours.

D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Smoke Detector: Integral, factory wired for single-point connection. Coordinate communication interface with fire alarm system as per specification section 283111.

G. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

L. Damper Actuator: 120Vac, two-position action, fail close.

M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.9 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.10 DUCT SILENCERS

A. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

B. Shape:

1. Rectangular straight with splitters or baffles.

2. Round straight with center bodies or pods.

C. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.034 inch thick.

D. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

E. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

F. Connection Sizes: Match connecting ductwork unless otherwise indicated.

G. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative type with fill material.

a. Fill Material: Moisture-proof nonfibrous material.
b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar.

H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Flange connections.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

2.11 TURNING VANES

A. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

B. Vane Construction: Single or Double wall.

C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.12 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.13 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.14 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.15 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2004.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.16 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. 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.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
4. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links.
5. At each change in direction and at maximum 20-foot spacing (kitchen hood exhaust only).
6. Control devices requiring inspection.
7. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with draw bands.

R. Install duct test holes where required for testing and balancing purposes.

S. 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.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

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SECTION 23 3423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections:

1. Division 01 Section "Submittal Procedures"
2. Division 23 Section "Basic Mechanical Requirements"
3. Division 23 Section "Common Motor Requirements"
4. Division 26 Section "Variable Frequency Motor Controllers"

1.2 SUMMARY

A. This Section includes the following:

1. Ceiling-mounting exhaust fans.
2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 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. Dampers, including housings, linkages, and operators.

6. Roof curbs.
7. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 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.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck
2. Twin City
3. Loren Cook
4. Penn Barry
5. Berner

2.2 CEILING-MOUNTING VENTILATORS

A. Description: Direct-driven centrifugal fans designed for installing in ceiling applications.

B. Wheel:

1. Forward curved centrifugal wheel
2. Constructed of galvanized steel or calcium carbonate filled polypropylene.
3. Statically & dynamically balanced in accordance with AMCA Standard 204-05.

C. Motor:

1. Motor enclosures shall be open driproof (ODP), opening in the frame body and or end brackets.
2. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase.
3. Motor shall be mounted on vibration isolators and be accessible for maintenance.
4. Compatible for use with speed controls.
5. Thermal overload protection.

D. Housing: Steel, lined with acoustical insulation.

E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Grille mounted motion detector with adjustable shutoff timer.
5. Isolation: Rubber-in-shear vibration isolators.
6. Manufacturer's standard aluminum roof jack or wall cap, with backdraft damper and transition fittings.

H. Capacities and Characteristics: See equipment schedules on drawings.

2.3 IN-LINE CENTRIFUGAL FANS

A. Description: In-line, direct driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

B. Wheel:

1. Aluminum construction.
2. Non-overloading, backward inclined centrifugal.
3. Statically and dynamically balanced in accordance with AMCA Standard 204-05.

C. Motors:

1. Motor enclosures: Open Type
2. Motor to be DC electronic commutation type motor (ECM) specifically designed for fan applications.
3. Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Motor shall be speed controllable down to 20% of full speed. Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
6. Motor shall be a minimum of 85% efficient at all speeds.

D. Housing:

1. Aluminum construction
2. Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars.
3. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

E. Disconnect Switches:

1. NEMA rated: 1.
2. Positive electrical shut-off.
3. Factory wired from fan motor to junction box.

F. Access Panel: Two sided access panels to permit easy access to all internal components.

G. Dampers:

1. Type: Gravity or motorized (Refer to Fan Schedule).
2. Prevents outside air from entering back into the building when fan is off.
3. Balanced for minimum resistance to flow.
4. Galvanized frames with pre-punched mounting holes.

H. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Companion Flanges: For inlet and outlet duct connections.
3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

I. Capacities and Characteristics: See equipment schedules on drawings.

2.4 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.5 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.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts having a static deflection of 1 inch. Vibration- control devices are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by code. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

E. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

F. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

G. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

H. Install units with clearances for service and maintenance.

I. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. 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 that 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. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

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SECTION 23 3522

STRAIGHT RAIL VEHICLE EXHAUST REMOVAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to put in working operation a complete turnkey system to remove both diesel and automotive exhaust gases and particulate of operating vehicles within the confines of specified fire station(s). All necessary controls, motors, fittings, ductwork, blower(s), labor and all other equipment and materials specified shall be part of the work.

B. Section Includes:
   1. Manufacturer.
   2. Rail Material.
   3. Top Mounting Suspension.
   4. Support Legs.
   5. Hydraulic Brake System.
   6. Rail Splicing Joint.
   7. Middle Rail Duct Connection.
   8. Trolley Assembly.
   9. Upper Flexible Hose.
   10. Lower Hose Assembly.
   11. Safety Disconnect Coupling Handle.
   12. Collection Nozzle Assembly.
   13. Hose Saddle.
   14. Electrical Controllers.
   15. Electrical System.
   16. Air Moving Devices.
   17. Ductwork System.

C. All items of equipment and materials described in these specifications are to be furnished installed and placed into proper operating condition in accordance with good practice and manufacturer's written or published instructions.
   1. The exhaust removal system shall provide virtually 100 percent complete evacuation of all diesel fumes at the source from start up to exit of the apparatus from the fire station. The diesel exhaust removal system shall be capable of delivering complete coverage for bays up to 120 feet (36.5M) in

length. The system must be able to accommodate drive through and back-in bays to meet all the needs of the fire department.

2. System must be designed and installed to NIOSH recommendation, specifying that occupational exposures to carcinogens be limited to the lowest feasible concentration. Exposure in the human breathing zone should be limited to lowest feasible level, without any time delay required for the system to effectively capture the diesel fumes.
3. System must also be capable to provide virtually complete capture and evacuation of carbon monoxide emitted as part of the vehicle exhaust.
4. Systems that solely use filters, in which diesel particulate may accumulate, and that would potentially have to be treated as hazardous materials, will not be accepted.
5. System must meet the guidelines for the International Mechanical Code for Source Capture Systems. Such system is defined as a mechanical exhaust system designed and constructed to capture air contaminants <u>at their source and to exhaust such contaminants to the outdoor atmosphere.</u>
6. The system shall not affect personnel boarding the apparatus. Hose loops shall not hang any lower then six feet from the bay floor. The hose assembly shall not come into contact with the vehicle other than one connection point to the vehicles tailpipe. The hose assembly shall not touch or drag on the bay floor.
7. The exhaust system shall not block doorways, exits, and aisles in the apparatus bay, which could endanger the welfare of fire personnel or visitors.
8. The exhaust system shall not need to be disconnected from the vehicle while shore lines are connected, during battery charging, or washing of the vehicle, as with other types of systems.
9. To protect the apparatus electrical system from possible damage, the system bid shall not incorporate any type of electromagnetic device that requires the apparatus to be utilized as an electrical ground for systems operation.

   When reviewing requests for substitutions are being reviewed, no exception to the following requirement should be allowed.

10. Due to the harmful effects of diesel exhaust, the system must be designed and capable of capturing virtually 100% of the exhaust gas and virtually 100% of the particulate even in the event of a complete power failure. The system shall not detach itself from the apparatus for any reason during a power failure other then normal exiting of the apparatus bay. System shall discharge exhaust outside the station even in the event of a power failure.
11. The system shall capture the exhaust gases and particulate directly from the tailpipe of the apparatus by a direct connected “visible” high temperature rated hose. Particulates emitted from the apparatus are known to be heavier than air and therefore must be captured by a directly connected hose with a tight seal, as loose nozzles or air filters cannot capture these heavy particulates. The particulates have been documented to be the main respirable carcinogen in diesel exhaust, and therefore are the primary concern of the fire department to capture virtually 100% of these particulates.

1.3 SUBMITTALS

A. Product Data: Indicate manufacturer's model number, technical data including description of components and static pressure/air flow chart, and installation instructions.
   1. Details of wiring for power differentiating between manufacturer-installed and field-installed wiring.
B. Closeout Submittals: Operation and Maintenance data manual including spare parts list.

1.4 QUALITY ASSURANCE

A. Engage a factory certified installer to perform work of this Section who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance. No Exceptions.

B. The manufacturer must be a ISO 9001:2008 certified www.iso.org manufacturer with certification issued to a United States facility, this shows a commitment to delivering the highest quality service and products to the end user. Manufacturer shall be UL and CUL Certified www.ul.com/database/ and certified by the Air Movement and Control Association (AMCA) www.amca.org/search.htm to ensure quality, consistency and reliability of products. All certification documents shall be provided and attached to the bid proposal. No exceptions. Where the requirement calls for a packaged exhaust system to be provided, all items shall be the product of the manufacturer. The product offering must be a product that has been offered by that manufacturer for a minimum period of fifteen (15) years. No prototypes or private label products by other manufacturers will be allowed. System bid shall have a life of service of no less than 10 years to establish proof of quality, longevity and service. No exceptions.

C. Engage a firm experienced in manufacturing vehicle exhaust systems similar to that indicated for this Project and with a record of successful in-service performance.

D. Conduct conference at Project site. Review methods and procedures related to vehicle exhaust system installation.
   1. Review access requirements for equipment delivery.
   2. Review equipment storage and security requirements.
   3. Inspect condition of preparatory work performed by other trades.
   4. Review structural loading limitations.
   5. Review that all components specified in this Section and related components specified in other Sections are accounted for.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Deliver components with protective packaging. Store in original protective crating and covering and in a dry location.

1.6 PROJECT/SITE CONDITIONS

A. Existing Conditions: Verify dimensions installation areas by field measurements.

1.7 COORDINATION

A. Coordinate layout and installation with other work, including light fixtures, fixed equipment and work stations, HVAC equipment, and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

1.8 REFERENCES

A. Air Movement & Control Association International, Inc.
   1. AMCA Standard 500-D-98, "Laboratory Methods of Testing Dampers for Rating".

B. ASTM International.
   1. Stainless Steel:
      a. A240/A240M-04ae1 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
      b. Bright, Directional Polish: No. 4 finish.
   2. Aluminum:
      a. B209/209M-04 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
      b. Powder-Coated Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
   3. Galvanized Steel:
      a. A653/A653M-04a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

1.9 BIDDER QUALIFICATIONS

A. Bids will only be accepted from companies that have an established reputation in the business of system design, turnkey installation and long-term service of Automatic Emergency Response Vehicle Exhaust Removal Systems for a minimum of no less than five (5) years. Bidder shall be a registered corporation, partnership or sole proprietorship within the State where the installation is to take place. Bidder must have a current and valid state contractor’s license, if required by the state for the work that is being bid. Bidder shall show proof that the system specified in this Bid Document has been field tested and proven by supplying a list of references with no less than 50 fire stations with systems installed by bidder (with comparable emergency and non-emergency run rates) within a 200 mile radius of municipality seeking bid. References shall be submitted with the Bid Document and shall include phone numbers and contact names.

1.10 MANUFACTURER QUALIFICATIONS

A. Bids shall only be accepted by bidders supplying equipment from manufacturers that have an established reputation in the business of manufacturing Automatic Emergency Response Vehicle Exhaust Removal Systems for a minimum of no less than fifteen (15) years. The manufacturer must be a ISO 9001:2008 Certified in the United States www.iso.org, UL and CUL Certified www.ul.com/database/ and certified by the Air Movement and Control Association (AMCA) www.amca.org/search.htm to ensure quality, consistency and reliability of products. Certification documents shall be provided and attached to the bid proposal. No exceptions. Where the requirement calls for a packaged exhaust system to be provided, all items shall be the product of the manufacturer. The product offering must be a product that has been offered by that manufacturer for a minimum period of fifteen (15) years. No prototypes or private label products by other manufacturers will be allowed. System bid shall have a life of service of no less than 10 years to establish proof of quality, longevity and service. No exceptions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. PlymoVent Corporation/Plymovent Industrial Ventilation Systems
115 Melrich Road
Cranbury, New Jersey 08512
USA
Telephone: (609) 395-3500
Toll Free: (800) 644-0911
FAX: (609) 655-0569
WEB: info@plymoventusa.com

Local Sales Contact;
XXXXXXXXXXXXXXXX

2.2 RAIL MATERIAL

A. Rail Material: One-piece continuous extruded aluminum rail in a minimum length of 19 feet (5791.2 mm) in an effort to reduce the points of leakage due to seams or connections. The construction profile shall be of a round profile type, diameter of 6.5 inches (165.1 mm) with a rail thickness of 0.175 inch (4.5 mm). The bottom portion of the rail shall have a continuous slot to accept a rubber seal. Rail Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Aluminum Rail: Extruded as a one piece design unit to maximize the structural integrity of the rail and to minimize joints. Extruded into the rail profile shall be all necessary mounting guides, which will allow for support of the rail mounting hardware and airline support cable. Mounting Channels: Provided continuously along both sides of the rail extrusion in order the proper positioning of all required mounting supports in accordance with codes. The rail shall allow the trolley/hose assembly to glide to the door threshold in a safe and effective manner. The extruded rail channel shall allow the

whole rail to remain rigid and shall provide an area to attach bolts for splicing additional rails together for systems over 19 feet (5791.2 mm) long. The overall extruded rail lengths shall be 19 foot (5791.2 mm) standard. Rail System: Equipped with a hydraulic braking system that limits travel of flex hose as the vehicle exits the building. Hydraulic Brake: Incorporated into the end cap of the suction rail.

2.3 TOP MOUNTING SUSPENSION

A. Top Mounting Suspension: Designed to attach with 2 mounting cleats to the mounting slots that were extruded into the rail profile. The top suspension mount support shall consist of 2 extruded Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M) and provided with 3 pre-punched holes for attaching the aluminum leg assembly to the rail.

2.4 SUPPORT LEGS

A. Support Legs: Manufactured and provided by the supplier of primary exhaust removal system (Equipment Manufacturer). Support Leg Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Supports: Standard in 19 feet lengths. A minimum of one support with appropriate bracing shall be provided for every 10 lineal feet(3 m) to 12 linear feet (3.7 m) of rail profile. The support legs shall consist of a square outer profile with dimensions no less than 2 inch (50.8 mm) OD by 0.1 inch (2.54 mm) by with 0.4 inch (10 mm) fastening hardware provided. The vertical adjustable mounting foot shall be capable of attaching the leg assembly to a ceiling with a 30 degree pitch, complete with 3/8 inch (9.5 mm) hardware necessary for mounting the leg assembly to the top suspension mount. The support leg shall be equipped with round tubular zinc-plated steel knee brace with pressed ends in standard lengths of 20 inch (508 mm), 30 inch (762 mm) and 72 inch (1828.8 mm). The angle shall be completely adjustable to the leg support and mounted perpendicular and parallel to direction of the rail. The typical support angle shall be 45 degrees from the centerline of the factory provided support leg. The standard leg shall be capable of meeting a Seismic Zone 4 requirement. Vertical support and bracing shall be provided to safely secure the rail profile in accordance with building code and seismic standards which may apply. A minimum of one support with appropriate bracing shall be provided for every 10 lineal feet (3 m) to 12 linear feet (3.7 m)of rail profile.

2.5 HYDRAULIC BRAKE SYSTEM

A. Hydraulic Brake System: Incorporated into the end cap of the suction rail profile. The hydraulic brake system must incorporate a hydraulic shock capable of reducing the forward impact of 1 to 4 suction trolleys which may be installed now or in the future to the exhaust rail system. This hydraulic shock shall be secured to a steel end cap fabricated of 6.25 inch (158.8 mm) diameter steel tubing with a wall thickness of 0.156 inch (4 mm) welded to a 0.156 inch (4 mm) steel plate with formed 90 degree side rails for rigidity. The end cap shall have a removable circular end plate to facilitate an end feed duct connection and shall be a black powder coated finish. The hydraulic shock shall be capable of reducing to a full stop the trolleys in less than 4 inch (101.6 mm), without physical damage to either the rail profile or trolley that it is stopping.

2.6 RAIL SPLICING JOINT

A. Rail Splicing Joint: The splice joint shall be formed aluminum extrusion equal to the internal diameter of the suction rail profile. The splice shall have a wall thickness of no less than .190 inches (4.8 m) in thickness and a length of no less than 8 inches (203.2 mm) from end to end. The rail splicing shall be safely secured by no less than 12- 3/8 inch 314.3 mm) by 1-½ inch (38.1 mm) bolts, nuts and lock washers. Each bolt shall pass through the exterior of the rail profile and splicing joint and be secured on the inside by a lock washer and nut. Self tapping bolts or screws are not acceptable.

2.7 MIDDLE RAIL DUCT CONNECTION

A. Middle Rail Duct Connection: The rail duct connection shall be rectangular to an 8 inch diameter round transition fitting fabricated from 24 gauge galvanized steel (ASTM A653) with a double rubber U style lip seal. The rectangular slot shall be 19 inch (482.6 mm) long by 1-¾ inch (44.5 mm) high with a 3/8 inch (9.5 mm) external flange to slide into the rail profile.

2.8 TROLLEY ASSEMBLY

A. Trolley Assembly: Gantry type trolley with sealed bearing loaded wheels designed to roll inside the internal rail profile flange. The trolley chassis shall be galvanized steel (ASTM A653) epoxy coated with a black finish. The chassis shall be fitted with a tapered cone. Rubber Sealing Lips: Vulcanized Teflon strip covering 1-½ inch (38.1 mm) of the bottom edge of the sealing lip which shall contact with (5) five Teflon rollers on each side of the transition to minimize resistance between the cone and the rubber sealing lips. The exhaust cone transition shall be a tapered slot design which shall fit inside the suction rail profile. The tapered slot shall be equal or exceed in area the diameter of exhaust ventilation hose to which it is attached. Trolley Assembly: Equipped with rubber impact bumpers at both the front and rear of the trolley chassis to eliminate metal to metal contact which could damage the trolley assembly. There shall be a system balancer assembly provided to aid in the delivery of the hose to the exit door. Balancer Assembly: Self-adjusting weight spring tension balancer with a lifting capacity of no less than 31 pounds (31 KG). The balancer shall have a minimum diameter steel cable of .080 inch (2 mm) and have a safety link connection.

2.9 UPPER FLEXIBLE HOSE

A. Upper Hose: Flexible exhaust hose manufactured for the sole purpose of venting high temperature exhaust gases. Flexible Hose: Designed strictly for the harsh environment of rapid response and auto-release of a vehicle exhaust tailpipe. Hose: Range from 4 inch (101.6 mm) to 5 inch (127 mm) diameters with length of 25 feet (7.6 m) without joining or splicing connections. Hose Material: High temperature synthetic rubber impregnated into a high temperature laminated fabric with a minimum overlapping thickness of 2-7/16 inches

(61.9 mm). This construction of hose must be capable of operating at continuous temperatures of 400 degrees F (204 degrees C) and intermittent temperatures of 500 degrees F (260 degrees C) such as are experienced when pump checks are performed inside the station. Wire Helix: Bound and protected in laminations of hose winding. This shall be accomplished in a fashion, which eliminates any possibility of personnel coming in contact with an exposed hot metal helix. The hose shall further protect the internal wire helix from heat buildup and in turn add increased visibility to personnel. Wear Strip: 9/16 inch (14.28 mm) wide and be provided as a safety yellow color. The bend radius of the high temperature hose shall be no less than 1.5 times the diameter of hose to ensure that hot gases are not restricted as they pass through the system. Hoses utilizing an exposed metal helix will not be acceptable due to potential burn hazard and/or shock hazard from being utilized as a grounded, grounding or current carrying conductor for electromagnet connections. No exceptions will be allowed.

2.10 LOWER HOSE ASSEMBLY

A. Lower Hose: Rigid 4 inch (101.6 mm) to 5 inch (127 mm) diameter by 2 foot (609.6 mm) long section of yellow and black hose identical in appearance to the upper hose assembly. Lower Hose: Support the pneumatic connection nozzle and chrome reducing elbow in a rigid fashion to allow for the operator to place hose collection nozzle onto the tailpipe without bending over. The lower hose is the only section of hose which shall disconnect from the upper hose assembly and act as a safety disconnect in the unlikely event the nozzle gets entangled. Hoses utilizing an exposed metal helix will not be acceptable due to potential burn hazard.

2.11 SAFETY DISCONNECT COUPLING /HANDLE

A. Safety Disconnect Coupling SDCH: An injection molded composite body with 360deg rubber bumper to protect the vehicle and disconnect from wear shall be incorporated in the design of the system. Coupling: Consists of two aluminum inner flange collars connected by a patented easy reconnect mechanism. The release tension of this device shall be preset at 99 pounds. And easily reconnected with only 3 pounds of force.

2.12 COLLECTION NOZZLE ASSEMBLY

A. Collection Nozzle Assembly: Provides a substantially air tight seal around exhaust tail pipe when connected thus allowing for virtually 100% source capture. The seal shall limit escape of life threatening exhaust gases

The Nozzle shall be engineered and designed with rare earth magnets that are strategically positioned on the face of the collection nozzle. The collection nozzle shall also incorporate a protective rubber safety cover to avoid damage to vehicle and surroundings. The tailpipe adapter shall be a conical design for aiding in the connection and release of the collection nozzle from the fire apparatus. The magnets shall only make contact with the face of the

adapter located on the tailpipe. The reducing elbow that connects to the connection nozzle shall be fabricated using continuous welded construction and shall be made from stainless steel. The angle of transition shall be no less than or greater than 67 degrees from the centerline of the reducer. The stainless steel reducer shall incorporate a primary expanded metal debris screen, which is permanently affixed by welded seams to the inside opening of exhaust fitting. Since this item is a point of safety for both personnel and the system itself, no exception will be allowed

2.13 HOSE SADDLE

A. Hose Suspension Saddle: Fabricated of a rubber molded cushion specifically manufactured for the sole purpose of suspending high temperature exhaust ventilation hose in a rapid response and auto-release application. The design of the saddle shall smoothly transition the direction of the hose during its travel along the rail. Securing clamps shall be provided including a link fastener, for the purpose of mounting it to the balancer safety link.

2.14 ELECTRICAL CONTROLLERS

A. Controller: Built and supplied by a UL recognized and listed exhaust system manufacturer. Controller shall carry the UL - CUL listing label as an “Enclosed Industrial Control Panel.” Individual components listed by UL - CUL shall not satisfy the above requirement. Manufacturer shall undergo monthly inspections by UL to verify all requirements and standards are met as outlined by UL. The controller shall be delivered as an Operating System Three series controller or an approved equal to the specifications to follow.

B. Electrical Controllers: Bear a visible UL listing label as proof of subscribership and shall be validated by UL www.ul.com/database/ as an “Enclosed Industrial Control Panel”. Certification documents shall accompany bid documents.
   1. Manufacturer Name: _____
   2. UL File No.: _____
   3. Electrical controller and manufacturer shall be recognized and listed by UL. Controller shall be manufactured in accordance with Underwriters Laboratories standard UL-508 for “Enclosed Industrial Control Panels”. The electrical controller shall include a Class 1 limited energy control circuit. Enclosures shall be NEMA 12 rated and UL listed as Type 12. The electrical control components shall be provided and mounted in an electrical enclosure to restrict access to internal components of the controller by authorized personnel only.

C. Controller Performance: Designed to sense the output pressure and/or temperature change inside the ductwork system, which is normally generated by any internal combustion engine designed to propel a motor vehicle. The operating logic shall be designed to complete this cycle. At any point in time when a collection device is connected to a motor vehicle's exhaust tailpipe, as the operator starts the vehicle, the controller shall automatically sense the engine's output pressure or temperature of the exhaust and in turn energize the electrical contactor which will supply power to the AMCA certified spark resistant fan motor. Through the use of an adjustable timer the controller shall keep the contactors

energized for up to six minutes in accordance with the stations response requirement. If the responding vehicle does not disconnect from the exhaust ventilation system in less than the designated setting, the temperature override switch shall override the time delay to ensure continuous system operation. This automated function will work for as long as the exhaust gas temperature is in excess of the setting on the heat sensor located in the ductwork system. This cycle shall not allow the electrical contactor, which energizes the exhaust fan, to short cycle or stop the fan while the system is connected to an operating vehicle.

D. Motor Control Contactor: Allen Bradley Industrial Electrical Contactor 100C series. The contactor shall be UL - CUL listed as an approved component.

E. Motor Control Overload Relay: Allen Bradley 193 E1 Plus series. Overload relay shall have an adjustable trip range to meet the proper full load amperage of the blower motor.

F. Soft Touch Controls: Incorporated on the face or the access door of the controller by the use of an adhesive backed Lexan membrane type label to prevent water infiltration, which would void the NEMA 12R rating. Label: Provided and secured permanently to the exterior of the electrical controller. Label: Include the name of the manufacturer, address, telephone number, user instructions and any warnings or cautions required by Underwriters Laboratories.
   1. Auto Start: This mode of operation shall be strictly for normal day to day use, as it would apply to receiving an emergency call and leaving the station. Any one or combination of the three devices listed below in Paragraph H shall activate the system. The system shall maintain itself in the Auto Start mode and always return there after the Stop sequence has been initiated. The controller shall not have a permanent off position due to the potential health hazards of diesel exhaust components.
   2. Stop: This mode of operation shall be a system override to shut down the system manually. Upon activating this mode of operation the exhaust system blower shall shut down. After a period not to exceed three seconds the controller shall automatically return to the Auto Start ready mode. This shall be a safety feature to prevent a potential health hazard from carcinogenic diesel exhaust leakage from systems having an undesirable open nozzle.
   3. Manual Run: This mode of operation shall be a system override to run the exhaust system blower continuously for the purpose of running the vehicles indoors for equipment checks during inclement weather. Upon activating this mode of operation the exhaust system blower shall start and run continuously until the Stop mode is activated at which point the system will automatically return to the Auto Start ready mode within a maximum three second time period.

G. System Indicator LED's: Show system status at all times.
   1. Auto Start Indicator: Indicate the system is in the fully automatic mode of operation and that power is on to the controller.
   2. Fan On Indicator: Indicate that power is being applied to the system blower and the controller is operating normally.

3. Filter Status Indicator: Indicates, if flashing, excessive pressure loss across the filter bank media. Consequently the filter must be serviced to maintain optimum efficiency of the system.
4. Stop Indicator: Indicate the fan has been manually de-energized and will return to the Auto Start ready sequence in less than three seconds to prevent the system blower from being left in the Off mode.
5. Manual Run Indicator: Indicate the fan is operating in a continuous run mode until interrupted by the stop mode activation.

H. Controller Transformer: UL listed industrial control circuit transformer sized to properly supply all components so that only one transformer shall be required. Transformer shall be provided with multi-tap primary for 115, 208, 240, 277, 400, 480, and 600VAC, and 24, 120, 230VAC secondary operating on 50 or 60 hertz with a capacity of 90 volt amperes.

I. Control Circuit Protection: By the use of primary and secondary fuses to meet UL requirements. The primary shall be protected by a pair of FLQ style fuses rated at 1.6 amps for voltages under 400V and a pair of .75 amp fuses for voltages over 400V. A single glass fuse rated at 3.15 amps at 250V shall protect the secondary side of the control circuit.

J. Electronic Control Circuit Card: Solid state printed circuit board. The soft controls shall be an integral part of the control circuit card. The control circuit card shall utilize a potentiometer to adjust the length of the timing cycle from 7 to 360 seconds. It shall incorporate several different modes of operation and optional features.

K. Activation Devices:
1. Engine Start Switch: An engine pressure sensing type, capable of recognizing the output pressure of any type of motor vehicle exhaust. The electrical contact shall be dry type or not to exceed 24V ac. There shall be one sensor per vehicle.
2. Thermal Start Switch: Temperature sensing switch of the snap disc type and adjustable from 90 degrees F (32 degrees C) to 130 degrees F (55 degrees C) to configure the system based on different exhaust temperatures. There shall be one sensor per vehicle.
3. Wireless Transmitter and Receiver System: Shall be an optional feature operating on a 900 Mhz spread spectrum frequency and FCC part 15 compliant. The receiver shall utilize 4 independent programmable channels of control and capable of supporting up to 16 transmitters. The receiver shall operate on 24 VAC and enclosed in a non metallic enclosure with a clear see through lid to view digital display for system supervisory functions. The transmitter shall be programmable and shall be powered by a 5 year 3 volt battery for ease of replacement and cost savings. The transmitter shall have an open field range of 2500 feet and shall be initiated by a NO contact closure such as from a pressure switch mounted on the exhaust system trolley/crab or a relay mounted on the vehicle.

L. Clean Filter Indicator Alarm: Used in conjunction with the optional Unifilter for filtering diesel exhaust particulate before release to the atmosphere. The clean filter indicator shall monitor the pressure loss across the filter bank media. Once the useful life of the filter has been depleted the pressure differential switch will signal a high-pressure loss and flash the “Fan On” indicator while the exhaust blower is running.

M. Optional System Monitor: Shall be an optional feature to monitor the system and advise when a preset number of emergency runs or run time on the system have accrued.

N. Optional No Airflow Alarm: Shall be an optional feature to monitor the system and advise when the exhaust fan is not functioning properly.

O. Optional Carbon Monoxide Alarm: Shall be an optional feature to monitor the carbon monoxide levels inside the apparatus bay area.

P. Electrical Wiring: Run in wire channel to allow for easier identification of the wiring circuits and for a neat appearance. All wiring circuitry shall meet National Electric Code and UL standards for proper size, bending radiuses (NEC code ref. 300-34) and terminations.

Q. Electrical Terminal Block: 600 V, UL rated and recognized. It shall provide individual connection points for remote controls, clean filter indicator and power connections. The primary and secondary control wiring fuses shall be incorporated into the terminal block as one unit.

R. Product Manual: Shall be provided with each electrical control box supplied. The product manual shall include a description of components with part numbers inclusive to the controller. It shall include a wiring schematic showing all internal circuitry as well as all field installed wiring connections to the controller.

S. Electrical Interference: To protect the apparatus and communications, designs that allow any possibility of electrical back-feed or induced current which may interfere with a central services communication or onboard vehicle computer logic or navigational equipment will not be accepted.

2.15 ELECTRICAL SYSTEM

A. Station Electric Supply Panel: The power circuit for the “Emergency Response Vehicle Exhaust Removal System” shall originate in a circuit breaker panel board of the appropriate size to handle the load. Fan circuit shall be supplied by a UL listed, HACR rated circuit breaker (HACR rating is specifically for motor type loads) of the same type as indicated by the manufacturer of the circuit breaker panel or a dual element time delay fuse for fuse style panels. The circuit shall be clearly marked on an engraved ledger plate or in ink on the panel schedule as “Emergency Response Vehicle Exhaust Removal System”.

B. OS-3 Automatic Controller: Built and supplied by a UL recognized and listed exhaust system manufacturer. Controller shall carry the UL - CUL listing label as an “Enclosed Industrial Control Panel”. Individual components listed by UL shall not satisfy the above requirement. Manufacturer must undergo monthly inspections by UL to verify all requirements and standards are met as outlined by UL. The controller shall be delivered as an Operating System Three series controller or an approved equal to the specifications in 2.17 Electrical Controllers. The controller shall be mounted 6 feet (1829 mm) to the top of the cabinet AFF (above finished floor). A safety disconnecting means must be within sight of the controller

for servicing and for safety reasons. If the supply panel is not within sight, a separate disconnecting means is required beside the controller (per NEC Code 2008). Safety disconnect shall be capable of being locked in the off and on position to follow lockout, tag out procedures. See attached Table 1-1 for proper Square D part number of safety disconnect switch.

C. Power Wiring Conduit: Minimum of EMT utilizing fittings for damp locations such as apparatus wash down areas (per NEC Code 2008). Conduit shall be supported with a conduit strap every 10 feet and within 3 feet of each box or termination, (per NEC 2008).

D. Power Wiring from Supply Panel to OS-3: THHN stranded copper wire consisting of a flame retardant, heat-resistant thermoplastic insulation with a nylon jacket for abrasion, gas, and oil resistance and rated up to 600 volts.

E. Low Voltage Control Wiring: Minimum of a 16/2 multi-conductor cable to meet UL standards for the controller's low voltage field wiring.

F. Low Voltage Control: Encased in a minimum of ½ inch (12.7 mm) EMT from the OS-3 Controller to the attic or building steel where it shall terminate with a EMT connector with a threaded plastic bushing. Conduit: Supported with a conduit strap every 10 feet and within 3 feet of each box or termination (per NEC Code 2008). The 16/2 multi-conductor cable shall be supported by the building structure and ran in a manner that the cable will not be damaged by normal building use (per NEC Code 2008), securely fastening it with nylon tie wraps every 24 inches (609.6 mm) to 36 inches (914.4 mm). Draping of the cable perpendicular to building steel or support members will be unacceptable.

G. Power Wiring from OS-3 to Fan Motor: Minimum of EMT utilizing compression type fittings for damp locations such as apparatus wash down areas (per NEC Code 2008). Conduit shall be supported with a conduit strap every 10 feet (3048 mm) and within 3 feet 914.4 mm) of each box or termination (per NEC Code 2008). Conduit shall extend through the outside wall through a hole of the proper size and terminate directly into the back of the safety disconnect with the appropriate connector and sealed with a silicon sealer or cement mortar. (Using fan model number select appropriate wire and conduit size from Table 1-1).

H. Fan Safety Disconnect: Square D, non-fusible, NEMA 3R rated for wet locations, mounted adjacent to the AMCA Certified blower. Safety disconnect shall be capable of being locked in the off and on position to follow lockout, tag out procedures. (Using fan model number select appropriate safety disconnect from attached Table 1-1).

I. Liquid Tight Flexible Metal Conduit: UL listed liquidtight flexible metallic conduit (Sealtite). Conduit will encase the load wires and ground wire from the safety disconnect switch to the blower motor. Conduit length not to exceed 4 feet (1219.2 mm) from disconnect to blower motor. The appropriate listed terminal fittings shall be used (per NEC Code 2008). (Using fan model select appropriate conduit size from attached Table 1-1).

J. Spark Resistant Blower: AMCA certified, designed and installed as a direct drive spark resistant blower (IMC code ref. 503.2) The motor shall meet current EPACT standards for energy savings. Fans utilizing steel impellers will not be accepted.

K. Optional Temperature Switch: One for each apparatus connected to the system. The temperature switch shall be of the snap disc type and adjustable from 90 degrees F (32 degrees C) to 130 degrees F (54 degrees C). It shall be mounted on the ductwork 2 inches (50.8 mm) above the pressure switch by drilling a 1 inch (25.4 mm) hole, sealing the switch with silicon sealant and securing with 2 tek screws. Electrical connection shall be made with terminals provided or solder less type such as Thomas & Betts part no. 14RB-2577 or equivalent.

L. Pressure Switch: One for each apparatus connected to the system. The pressure switch shall operate at a maximum of 24VAC, pre-calibrated at .18 in. of water column. Mounting shall be accomplished by drilling a 3/8 inch (9.5 mm) hole 3 inches 76.2 mm) above the riser bracket and to the left of the regulator and threading the switch into the duct. The electrical connections shall be made with a 0.020 inch (.5 mm) by 0.187 inch (4.8 mm) female quick disconnect terminals, such as Thomas & Betts part no. 14RBD-18277 or equivalent.

OS-3 Controller Component Sizing Chart

Table 1-1

Single Phase

	Motor	HP	Name Plate		Circuit	Wire Size	Length of Wire in Feet		NEC	
PlymoVent	Manuf.	Rating	Voltage	FLA	Breaker	THHN	Start to Finish		Table	
Model					Size	AWG	From	To	Amps	
No. 67001	Leeson	1hp	115V	12A	20A	#10	0'	115'	16A	
						#8	116'	184'		
			230V	6A	15A	#14	0'	183'	8A	
						#12	184'	290'		
67003	Leeson	3hp	230V	16A	30A	#10	0'	215’	17A	
67005	Leeson	5hp	230V	24A	40A	#8	0'	216'	28A	
67007	Marathon	7.5hp	230V	32A	50A	#8	0'	133'	40A	
						#6	134'	211'		
						#4	212'	336'		
67009	Marathon	10hp	230V	41.5A	60A	#6	0'	167'	50A	
67012						#4	168'	266'		
67013						#3	267'	335'		

Three Phase										
67002	Leeson	1hp	208V	3.2A	15A	#14	0'	358'	4.6A	
			230V	3.6A	15A	#14	0'	352'	4.2A	
			460V	1.8A	15A	#14	0'	1409'	2.1A	
67004	Leeson	3hp	208V	8A	15A	#12	0'	181'	10.6A	
			230V	7.4A	15A	#12	0'	223'	9.6A	
			460V	3.7A	15A	#14	0'	563'	4.8A	
67006	Leeson	5hp	208V	12.8 A	30A	#10	0'	187'	16.7A	
						#8	188'	298'		
			230V	12A	30A	#10	0'	229'	15.2A	
			460V	6A	15A	#14	0'	362'	7.6A	
67008	Leeson	7.5hp	208V	17.6 A	30A	#10	0'	145'	24.2A	
						#8	146'	231'		
						#6	232'	366'		
			230V	16.8 A	30A	#10	0'	174'	22A	
						#8	175'	278'		
			460V	8.4A	15A	#14	0'	275'	11A	
						#12	276'	437'		
67010	Leeson	10hp	208V	25.9 A	40A	#8	0'	178'	30.8A	
67011						#6	179'	282'		
			230V	23.6 A	40A	#8	0'	215'	28A	
						#6	216'	340'		
			460V	11.9 A	20A	#12	0'	338'	14A	
67014	Leeson	15hp	208V	38.5 A	60A	#6	0'	190'	46.2A	
						#4	191'	303'		
			230V	35A	60A	#6	0'	231'	42A	
						#4	232'	369'		
			460V	17.6 A	30A	#10	0'	365'	21A	

PlymoVent assumes no liability for any electric installation, all local, city, and the 2008 National Electric Code must be followed. This chart is a minimum standard and to be used as a guideline only. Based on 3% voltage drop for branch circuits.

TEVA Fan Component Sizing Chart

Table 1-2

Single Phase										
	Motor	HP	Name Plate		Circuit	Wire Size	Length of Wire in Feet		NEC	
PlymoVent	Manuf.	Rating	Voltage	FLA	Breaker	THHN	Start to Finish		Table	
Article					Size	AWG	From	To	Amps	
No.										
3906-A251	WEG	3hp	230	13.5	30A	#10	0’	206’	17A	
3911-A251	WEG	5hp	230	21	30A	#10	0’	132’	28A	
						#8	133’	211’		
3912-A251	WEG	7.5hp	230	32	50A	#8	0’	138’	40A	
						#6	139’	219’		
						#4	220’	350’		
Three Phase										
3906-A081	WEG	3hp	208	8.4	15A	#14	0’	136’	10.6A	
			230	7.6	15A	#14	0’	166’	9.6A	
			460	3.8	15A	#14	0’	667’	4.8A	
3911-A081	WEG	5hp	208	13	30A	#10	0’	223’	16.7A	
			230	11.8	20A	#12	0’	170’	15.2A	
						#10	171’	272’		
			460	5.9	15A	#14	0’	430’	7.6A	
3912-A081	WEG	7.5hp	208	19.2	30A	#10	0’	151’	24.2A	
						#8	152’	241’		
			230	17.3	30A	#10	0’	185’	22A	
						#8	186’	295’		
			460	8.66	15A	#14	0’	293’	11A	

PlymoVent assumes no liability for any electric installation, all local, city, and the 2008 National Electric Code must be followed. This chart is a minimum standard and to be used as a guideline only. Based on 3% voltage drop for branch circuits.

2.16 AIR MOVING DEVICES

A. Centrifugal Fans: Direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller Wheels: Radial design or backward incline for performance, spark resistant and made of a non ferrous material to prevent static electricity build up. The impeller shall be dynamically and statically balanced and of the

non-overloading type to provide maximum efficiency while achieving quiet, vibration-free operation. The fan housing shall be manufactured from a epoxy powder coated galvanized steel or nonferrous material. The outlet configuration shall be top horizontal, bottom horizontal, or upblast. The housing shall be capable of field reconfiguration in the event the mounting position needs to be changed for unforeseen reasons. For aesthetic reasons the fan motor and assembly shall be mounted on a welded Type 304 stainless steel (ASTM A240/A240M) or epoxy powder coated steel mounting base to prevent rust stains on the exterior of the building. The fan housing and motor mounting hardware shall be Type 304 stainless steel (ASTM A240/A240M) for serviceability reasons.

B. Fan Motor and Bearing: All 1 horsepower (746 watts) to 15 horsepower (11190 watts) motors shall be totally enclosed fan cooled (TEFC) continuous duty rated. The motors shall be dual voltage where applicable. Motors built after October 27th, 1997 shall comply with the government mandated "Energy Policy and Conservation Act" (EPACT) as outlined by the Department of Energy. The bearings shall be self-aligned, ball bearing type permanently sealed and lubricated. The exhaust discharge outlet shall be in compliance with International Mechanical Code and ACGIH recommendations (min. of 36" above roofline). Air intakes, windows, cascade systems, prevailing currents, communication equipment and building aesthetics shall be considered in the final location of the fan.
   1. Teflon Shaft Seal: The fan shaft shall be steel and rotate in a non-sparking TEFLON seal to prevent leakage and to prevent hot exhaust gases from coming into contact with the motor bearings.
   2. Variable Speed Drive: The motor shall be compatible with a variable speed drive unit.

C. Performance: The delivered volume shall take into account all the static regain of vehicle engine exhaust (based on an airtight connection at the tailpipe), lengths of ductwork, elbows, branches, shut off, wyes, etc. which accumulate the static pressure at the field inlet. The manufacturer's provided fan(s) shall be performance guaranteed.
   1. Fan Capacity: The Fan Capacity shall be sized as such as to deliver the required CFM at each hose drop to which the vehicle is attached.
      a. The 4 inch (101.6 mm) hose system shall be designed to deliver a minimum of 500 CFM (2.9 M/Second) at a velocity of 5800 FPM (33.6 M/Second) at the hose and nozzle connection.
      b. The 5 inch (127 mm) hose system shall be designed to deliver a minimum of 750 CFM (4.4 M/Second) at a velocity of 5800 FPM (33.6 M/Second) at the hose and nozzle connection.
      c. The 6 inch (152.4 mm) system shall be designed to deliver a minimum of 1100 CFM (6.4 M/Second) at a velocity of 5800 FPM (33.6 M/Second) at the hose and nozzle connection.

D. Location: The preferable fan location shall be on the outside of the fire station as far away from any living quarters as possible so that firefighters would not be disturbed by the system activation. No blower fans shall be mounted inside the fire station. Silencers shall be provided when fan sound pressure level exceeds 64 dB.

2.17 DUCTWORK SYSTEM

A. Ductwork Type and Materials: UMC Class 2 or SMACNA Class II product conveying duct, meet or exceed criteria for construction and performance as outlined in Round Industrial Duct Construction Standards, SMACNA. Materials of construction unless otherwise specified for all ductwork and fittings shall be a minimum G-90 galvanized sheet metal (ASTM A653/A653M). Only when specified, Type 304 stainless steel (ASTM A240/A240M) shall be provided.

B. Ductwork Sizing and Gauges: Round pipe construction, with the range of available sizes not to exceed 10 inches (254 mm) in diameter. Duct gauge shall depend on diameter and a minimum operating pressure of 8 inches water gauge (1990 Pa). Acceptable Gauge and Reinforcement Requirements: Inner duct diameter 4 inches (101.6 mm) through 11 inches (279.4 mm) diameter shall be 22 gauge standard pipe (International Mechanical Code).

C. Ductwork Fittings: Round and have a wall thickness 2 gauges (one even gauge number) heavier than the lightest allowable gauge of the downstream section of duct to which they are connected (International Mechanical Code). Air Duct Branch Entrances: Factory fabricated fittings or factory fabricated duct /tap assemblies. Fittings: Constructed so that air streams converge at angles no greater than 45 degree (International Mechanical Code). All Seams: Continuous stitch welded and if necessary internally sealed to ensure air tightness. Turning elbows shall be stitch-welded and used for all diameters and pressures. They shall be fabricated of 24 gauge galvanized steel and constructed as two piece with continuous welded seam construction fittings similar to those provided by Lindab Inc. Tapered Body Fittings: Used wherever particular fallout is anticipated and where air flow is introduced to the transport duct manifold.

D. Ductwork Design Velocities: Minimum of 3500 FPM (20.3 M/Second) to 4000 FPM (23.2 M/Second) transport velocity. Capture Velocity: 5500 FPM (31.9 M/Second) to 6000 FPM (34.8 M/Second) to extract virtually 100 percent of the exhaust gases.

E. External Ductwork: Sized for the exact inlet and outlet of the exhaust fan blower. An exhaust rain cap shall be supplied and manufactured in accordance with EPA standard for free draft rain cap requirements. Included as an integral part of this rain cap shall be a back draft damper to provide protection from rain and other inclement weather.

F. Exhaust Penetrations: The core drilling shall be properly sized to reduce the diameter of the opening to the smallest possible size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide surface/substrate preparation as required by the manufacturer's printed installation instructions. Do not proceed with installation is in proper condition to receive vehicle exhaust system installation.

3.3 INSTALLATION

A. Install vehicle exhaust system in accord with manufacturer's written instructions, original design and referenced standards.

3.4 ADJUSTING

A. Adjust vehicle exhaust system for proper operation. Replace any parts that prevent the system from operating properly.

3.5 CLEANING

A. Remove all debris caused by installation of the vehicle exhaust system. Clean all exposed surfaces to as fabricated condition and appearance.

3.6 PROTECTION

A. Provide protection of the completed installation until completion of the project. Repair any damage at no additional cost to Owner.

3.7 TRAINING

A. Provide training to fire department personnel in the daily use and maintenance of the vehicle exhaust removal system that has been installed and specified herein. The fire department shall be notified at least 7 days prior to the date scheduled for the training course. Training shall be for all personnel involved with the operation of the exhaust removal system to include all shifts required to man the particular facility. The Training session shall be performed in person by a recognized representative of the manufacturer of the exhaust removal system, in addition a training video shall be provided to the fire department.
   1. Provide training to all shifts during their normal shift period.

3.8 WARRANTY

A. Provide a written warranty for a period of 1 year from date of shipment for all components.

END OF SECTION

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SECTION 23 3713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Linear slot diffusers.
4. Modular core supply grilles.
5. Adjustable bar registers and grilles.

B. Related Sections:

1. Division 01 Section "Submittal Procedures”
2. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts
3. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus
   2. Nailor
   3. Price
   4. Kreuger
   5. Metalaire

2.2 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

   1. Material: Aluminum.
   2. Finish: Baked enamel, white.
   3. Face Size: 24 by 24 inches.
   4. Mounting: Surface or T-bar to match ceiling type.
   5. Pattern: Adjustable.
   6. Dampers: None.

2.3 REGISTERS AND GRILLES

A. Ceiling mounted and duct mounted:

   1. Material: Aluminum.
   2. Finish: Baked enamel, white.
   3. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
   4. Core Construction: Removable.
   5. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
   6. Frame: 1-1/4 inches wide.
   7. Mounting: Countersunk screw.
   8. Damper Type: Adjustable opposed blade.
   9. Accessories:

      a. Front-blade gang operator.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

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SECTION 23 8126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Outdoor Condensing Unit

1. Outdoor-mounted, air-cooled condensing unit suitable for on-the-ground or rooftop installation. Unit shall consist of a hermetic scroll air- conditioning compressor(s) assembly, an air-cooled coil, propeller-type condenser fans, and a control box. Unit shall discharge supply air upward as shown on the contract drawings. Unit shall be used in a refrigeration circuit matched with a packaged air-handling unit.

B. Indoor Air Handling Unit

1. Indoor, packaged air-handling unit for use in commercial split systems. Units shall have a multi-position design and shall be capable of horizontal or vertical installation on a floor or in a ceiling, with or without ductwork.

2. Unit with direct-expansion coil shall be used in a refrigerant circuit with a matching air-cooled condensing unit.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: 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.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Sample of special warranty.

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.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRENTY

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five years from date of Substantial Completion.

b. For Parts: One Year from date of Substantial Completion
c. For Labor: One Year from date of Substantial Completion

PART 2 – PRODUCTS

2.1 OUTDOOR CONDENSING UNIT

A. General: Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, holding charge, and special feature required prior to field start-up.

B. Unit Cabinet:

1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.

2. A heavy-gauge roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.

C. Condenser Fans:

1. Condenser fans shall be direct driven, propeller type, discharging air vertically upward.

2. Fan blades shall be balanced

3. Condenser fan discharge openings shall be equipped with PVC-coated steel wire safety guards.

4. Condenser fan and motor shaft shall be corrosion resistant.

D. Compressor:

1. Compressor shall be of the hermetic scroll type.

2. Compressor shall be mounted on rubber grommets

3. Compressors shall include overload protection.

4. Compressors shall be equipped with crankcase heater.

5. Compressor shall be equipped with internal high pressure and high temperature protection.

E. Condenser Coil:

1. Condenser coil shall be air-cooled and circuited for integral sub-cooler.

2. Standard condenser coils for all models, except 25 size, shall have all aluminum NOVATION™ Heat Exchanger Technology design consisting of aluminum multi-port flat tube design and aluminum fin. Coils shall be a furnace brazed design and contain epoxy lined shrink wrap on all aluminum to copper connections. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 199 burst test at 1980 psig.

F. Refrigeration Components:

1. Refrigeration circuit components shall include liquid line service valve, suction line service valve, a full charge of compressor oil, and a partial holding charge of refrigerant.

G. Controls and Safeties:

1. Minimum control functions shall include:

a. Control wire terminal blocks.

b. Compressor lockout on auto-reset safety until reset from thermostat

c. Each unit shall utilize the Comfort Alert™ Diagnostic Board that provides:

1. System Pressure Trip fault code indication

2. Short Cycling fault code indication

3. Locked Rotor fault code indication

4. Open Circuit fault code indication

5. Reverse Phase 3 fault code indication

6. Welded Contactor fault code indication

7. Low Voltage fault code indication

8. Anti-short cycle protection

9. Phase reversal protection

2. Minimum safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:

a. High discharge pressure cutout.

b. Low pressure cutout.

H. Operating Characteristics

1. The capacity of the condensing unit shall meet or exceed the specifications scheduled on the drawings.

2. Standard unit shall be capable to operate up to 125^{0}F (52^{0}C) and down to 40^{0}F (4^{0}C)

I. Electrical Requirements

1. Nominal unit electrical characteristics shall be as specified on the air unit schedule on the drawings.

2. Unit electrical power shall be single-point connection.

3. Unit control circuit shall contain a 24-v transformer for unit control.

J. Special Features:

1. Condenser Coil Protective Coating – E-Coated Novation coil:

   a. E-Coated aluminum Novation cols shall have a flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. Coating process shall ensure complete coil encapsulation, including all exposed fin edges. E-Coat thickness of 0.8 to 1.2 mil with top coat having a uniform dry film thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided. E-coated coils shall have superior hardness characteristics of 2H per ASTM D3363-00 and cross hatch adhesion of 4B-5B per ASTM D3359-02. E-coated products shall have superior impact resistance with no cracking, chipping or peeling per NSF/ANSI 51-2002 Method 10.2.

2. Low-Ambient Temperature Control:

   a. A low-ambient temperature control shall be available as a factory-installed option or as a field-installed accessory. This low-ambient control shall regulate speed of the condenser-fan motors in response to the saturated condensing temperature of the unit. The control shall maintain correct condensing pressure at outdoor temperatures down to -20^{0}F (-29^{0}C).

3. Unit-Mounted, Non-Fused Disconnect Switch:

   a. Switch shall be factory-installed and internally mounted. NEC and UL-approved non-fused switch shall provide unit power shutoff. Switch shall be accessible from outside the unit and shall provide power off lockout capability.

4. Thermostat Controls:

a. Programmable multi-stage thermostat shall have 7-day clock, holiday scheduling, large backlit display, remote sensor capability, and Title 24 compliance.

2.2 INDOOR AIR HANDLING UNIT

A. Indoor mounted, draw-thru packaged air-handling unit that can be used in a suspended horizontal configuration or a vertical configuration. Unit shall consist of a forward-curved belt-driven centrifugal fan(s), motor and drive assembly, pre-wired fan motor contactor, factory-installed refrigerant metering devices (direct-expansion coil units), cooling coil, 2-in. (51-mm) disposable sir filters, and condensate drain pans for vertical or horizontal configurations.

B. Base Unit:

1. Cabinet shall be constructed of mill-galvanized steel.

2. Cabinet panels shall be fully insulated with ½-in. (12.7-mm) fire-retardant material. Insulation shall contain an EPA-registered immobilized antimicrobial agent to effectively resist the growth of bacteria and fungi as proven by tests in accordance with ASTM standards G21 and 22 (U.S.A.).

3. Unit shall contain non-corroding condensate drain pans for both vertical and horizontal applications. Drain pans shall have connections on right and left sides of unit to facilitate field connection. Drain pans shall have the ability to be sloped toward the right of left side of the unit to prevent standing water from accumulating in pans.

4. Unit shall have factory-supplied 2-in. (51 mm) throwaway-type filters installed upstream from the cooling coil. Filter access shall be from either the right or left side of the unti.

C. Coils:

1. DX coil is 4-row and consists of copper tubes with sine-wave aluminum fins bonded to the tubes by mechanical expansion. Suction and liquid line connections or supply and discharge connections shall be made on the same side of the coil.

a. Direct-expansion coils shall feature factory installed thermostatic expansion valves (TXVs) for refrigerant control. The TXVs shall be Puron® R-410A compatible and capable of external adjustment. Direct-expansion heat pump coils shall have a factory-installed bypass line and check valve assembly around the TXVs to allow liquid flow from the coil to the outdoor unit during the heating mode. Coil tubing shall be internally rifled to maximize heat transfer.

D. Operating Characteristics:

1. Unit shall be capable of providing CFMs and external static pressure as scheduled on the drawings.

E. Motor:

1. Fan motor of the size and electrical characteristics specified on the equipment schedule shall be factory supplied and installed.

2. Motors rated at 1.3 through 3.7 hp (0.97 through 2.76 kW) shall have internal thermal overload protection.

3. Evaporator-fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers. Evaporator motors are designed specifically for Carrier and do not have conventional horsepower (hp) ratings listed on the motor nameplate. Motors are designed and qualified in the “air-over” location downstream of the cooling coil and carry a maximum continuous bhp rating that is the maximum application bhp rating for the motor; no “safety factors” above that rating may be applied.

4. All evaporator-fan motors 5 hp and larger shall meet the minimum efficiency requirements as established by the Energy Policy Act of 1992 (EPACT), effective October 24, 1997.

F. Electric Heaters:

1. Heaters for nominal 240, 480, or 575-volt, 3-phase, 60 Hz shall be factory-supplied for field installation as shown on the equipment drawings. Electric heat assembly shall be ETL (U.S.A.) and TEL, Canada, agency approved, and shall have single-point power wiring. Heater assembly shall include contactors with 24-v coils, power wiring, 24-v control wiring terminal blocks, and a hinged access panel. Electric heaters shall not be used with discharge plenum.

G. Overhead Suspension Package:

1. Package shall include necessary brackets to support units in a horizontal ceiling installation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

D. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base that is 4 inches (100 mm) larger, on each side, than

unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

E. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

F. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

H. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts" Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

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. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

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SECTION 23 8128

DUCTLESS SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes ductless split-system heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

B. Related Sections:

1. Division 01 Section “Submittal Procedures”

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: 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.

C. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

D. Warranty: Sample of special warranty.

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.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-Up."
3. ASHRAE 90.1-2004.

C. Units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.

1.5 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years, parts and labor, from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier [Basis of Design]
2. Daikin
3. Mitsubishi
4. LG

2.2 INDOOR UNIT (WALL MOUNTED)

A. General

1. Indoor, direct--expansion, wall--mounted fan coil. Unit shall be complete with cooling/heating (heat pump systems only) coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall mounting bracket and mounting hardware.

2. Cabinet discharge and inlet grilles shall be attractively styled, high--impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.

3. Fans:

   a. Fan shall be tangential direct--drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor--driven vertical air sweep shall be provided standard. Automatic motor--driven horizontal air sweep shall be provided standard on sizes 030 and 036.

   b. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set manually on unit sizes 018 and 024.

4. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specifically coated for enhanced wettability. A drip pan under the coil shall have two drain connections for hose attachment, on either the left or right-hand side, to remove condensate. Condensate pan shall have internal trap.

5. Motor4s shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.

6. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 62^0F to 84^0F. user interface with the unit shall be accomplished through the standard wireless remote control (can be configured for ^{0}F or ^{0}C) or an optional wired controller or Zone Manager. The unit shall have the following functions as a minimum

   a. And automatic restart after power failure at the same operating conditions as at failure
   b. A timer function to provide a minimum 24-hour timer cycle for system Auto Strat/Stop
   c. Temperature-sensing controls shall sense return air temperature.
   d. Indoor coil freeze protection.
   e. Automatic vertical air sweep control to provide on or off activation of air sweep louvers. Automatic horizontal air sweep is available in sizes 030 and 036.
   f. Dehumidification mode shall provide increased latent removal capability by modulating system operation and set point temperature.
   g. Fan-only operation to provide room air circulation when no cooling is required.
   h. Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.

i. Fan speed control shall be user-selectable: high, medium, low, or microprocessor control automatic operation during all operation modes.
j. Automatic heating-to-cooling changeover in heat pump mode. Control shall include deadband to prevent rapid mode cycling between heating and cooling.

7. Unit shall have filter track with factory--supplied cleanable filters..

8. Indoor units shall be 208/230--1--60 and require their own power supply. Only control wiring shall run between the indoor and outdoor units.

9. The 40QNC/QNQ, when matched with the appropriate outdoor section, shall have a minimum listed SEER (seasonal energy efficiency ratio) of 13 at ARI conditions, and a minimum HSPF of 7.7.

10. All units should have refrigerant lines that can be oriented to connect from the left, right or back of unit. Both refrigerant lines need to be insulated.

11. Special Features (Field Installed)

a. The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. Pump shall be designed for quiet operation. Pump shall consist of two parts: an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. A liquid level sensor in the reservoir shall stop cooling operation if liquid level in the reservoir is unacceptable.
b. The wired control can replace the standard wireless control and provide the User Interface to control one unit or up to 6 units daisy-chained together.
c. The Zone Control can provide the capability of connecting up to 32 units into one or up to 8 independent zones. Each zone can be programmed for 7 days with each day having up to 4 periods.

2.3 OUTDOOR UNIT

A. Outdoor air--cooled split system compressor sections suitable for on--the--ground, rooftop, wall hung or balcony mounting. Units shall consist of a scroll compressor, an air--cooled coil, propeller--type blow--through outdoor fan, reversing valve (HP), accumulator, Accurator metering device(s), and control box. Units shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air--to--air cooling only, or heat pump system.

B. Units shall be used in a refrigeration circuit matched to duct--free cooling only or heat pump fan coil units.

C. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and compressor

D. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish on inside and outside.

E. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.

F. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

G. Compressor compartment shall be isolated to allow performing diagonostics while the system is running.

H. Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall blow air through outdoor coil.

I. Outdoor fan motor shall be totally-enclosed, single phase motors with class B insulation and permanently-lubricated bearings. Motor shall be protected by internal thermal overload protection.

J. Shaft shall have inherent corrosion resistance.

K. Fan blades shall be metallic and shall be statically and dynamically balanced.

L. Outdoor fan openings shall be equipped with PVC coated metal protective grille over fan.

M. Compressor shall be fully hermetic scroll type.

N. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-temperature and over-current.

O. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.

P. Compressor assembly shall be installed on rubber vibration isolators.

Q. Compressors shall be available in single-phase (sizes 018-036) and three-phase (size 036)

R. Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

S. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gag connection port, service gage port connection on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve.

T. Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:

1. Controls:
   a. A time delay control sequence is provided standard through the fan coil board.
   b. Automatic outdoor – fan motor protection
2. Safeties:
   a. Diagnostics provided by matched indoor unit.
   b. Compressor motor current and temperature overload protection.
   c. Outdoor fan failure protection (High Pressure Switch).
   d. Low pressure protection.
   e. Fusible plug to vent refrigerant safely in case of fire

U. All sizes shall operate on single-phase, 60 Hz power at 208/230V or on three-phase, 60 Hz power at either 208/230 or 460 (for 036 size units)

V. Unit control voltage to the indoor-fan coil shall be 24 VDC.

W. All power and control wiring must be installed per NEC and all local electrical codes.

X. The unit shall be capable of 200ft maximum piping, a maximum lift (fan coil above) of 65 ft and a maximum drop of 150 ft. Accessories will be required to achieve these lengths.

Y. Low-Ambient Kit: control shall regulate fan-motor cycles in response to saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of 100^0F $\pm$ 10^0F with outdoor temperatures to -20^0F. Installation of kit shall not require changing the outdoor fan motor.

Z. Crankcase Heater

AA. Wind Baffle

BB. Stacking Kit

CC. Wall Mounting Kit.

2.4 ACCESSORIES

A. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

2.5 CAPACITIES AND CHARACTERISTICS

A. See equipment schedules on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install indoor units level and plumb on wall with factory provided wall mount bracket.

B. Coordinate electrical conduit, refrigerant, and condensate routing.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install and connect precharged refrigerant tubing to component. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

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. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment. Training shall include all preventive maintenance tasks, required frequencies, and use of parts required for servicing.

END OF SECTION

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit for review all requested product data, shop drawings and samples. All cuts, catalogs, bulletins, diagrams, curves, etc., shall be submitted in six (6) copies. Trade names, manufacturers, and catalog numbers are mentioned herein and on the Drawings solely in order to establish a standard for the type, general design, and quality of product required. Other products similar in design of approved equal quality capable of fitting within the spaces allocated and complying with the Drawings and Specifications will be considered after the Contract is let unless "prior approval" requirements are set forth in these documents. Where two or more manufacturers or materials are named the Contractor may submit any of those named, provided they conform to the Specifications and design intent. The Architect may require the submission of samples, particularly wherever equipment or appliances are visible in finished areas. Demonstrations of a product's ability to perform as specified shall be arranged if required. Dimensional data and weights

shall be included. Review of submittals and shop drawings does not relieve the Contractor of the responsibility for fitting the equipment in the space allotted with space for electrical connection and for servicing, or for coordination of the work with that of other trades. Contractor shall review submittals and shop drawings and indicate by stamp or letter that he has reviewed them before forwarding them to the Architect. Submittals and Drawings will be returned after review indicating whether or not exceptions are taken and the required procedure to be followed thereafter. Resubmission of revised submittals and shop drawings is required before construction is begun.

B. Corrections or comments made on the submittals and drawings during this review do not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. This review is for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction.

C. If the submittal deviates from the requirements of the Contract Documents, the deviation shall be identified in writing on the first page of the submittal. Identify where within the Contract Documents the deviation occurs. The deviation shall only be considered acceptable if the identified deviation has been initialed by the Engineer. Any deviation not initialed may be assumed to be rejected. All coordination required due to the deviation, such as space allocation, changes to electrical service, or any other required changes shall be borne as Work of Division 26 but accomplished by Installers skilled in the Work being performed. No costs incurred by the approved deviation shall be borne by the Owner.

D. The products listed below shall be submitted for review after the award of the Contract and before any equipment or materials are purchased. If a product is unacceptable, another product shall be submitted.

1. Items to be submitted are:
   a. Panelboards
   b. Lighting fixtures, ballasts & lamps
   c. Motor starters (manual & magnetic)
   d. Combination starter & disconnect switches
   e. Disconnect switches & fuses
   f. Circuit breakers
   g. Fire alarm system components
   h. Conductors
   i. Lightning Protection system components
   j. Underground pre-cast junction boxes
   k. In-floor and poke through junction boxes
   l. Variable frequency drives
   m. Intercom

E. Further descriptions or information required with shop drawings shall be included with the description of materials specified herein as follows:

1. Panelboards and Enclosures: Include dimensioned drawings of panelboards and enclosures showing accurately scaled layout of enclosure and required unit sections, including but not necessarily limited to circuit breakers, fusible switches and accessories. Submit, if requested, transparencies of circuit breaker characteristics with unlatch times and fuse characteristics with melting/clearing times for use by the Architect in verifying coordination of these devices.
2. Safety and Disconnect Switches: Include dimensioned drawings of electrical safety and disconnect switches which have a rating of 30 amperes or larger, showing the accurately scaled switches their layout, and relation to associated equipment.
3. Grounding Products: Include a complete grounding system diagram with materials and ground conductor sizes.
4. Motor Starters: Include dimensioned drawings of motor starters which have a NEMA size one or larger rating, their layout, and relation to associated equipment
5. Miscellaneous Electrical Controls and Control Wiring: Include control wiring diagrams for all miscellaneous electrical controls.
6. Lighting Fixtures: Include certified test data showing return air performance of return air fixtures, both with heat extract slots only, and with heat extract slots and both side slots.
7. Combination Fire Alarm System Components: Include shop drawings showing combination fire alarm system riser and wiring diagrams and dimensioned drawings of Fire Alarm Control Panel. Include certification that this Division has fully coordinated all fire alarm system signal and control connections with work of other Divisions, including but not limited to, automatic temperature controls, fire pump, fire sprinkler system, and elevators.
8. Housekeeping Pads: Include location and dimensions of housekeeping pads, including blockouts and anchor bolts.
9. Firestops: Include all firestop materials for the project, indicating intended use and UL fire rating where applicable.
10. Detailed, dimensioned shop drawings for the installation of the work in the electrical equipment rooms (areas) shall be prepared and submitted for review. These drawings shall be new drawings prepared by the Contractor and shall not be reproductions or tracings of the Architect's Drawings. In preparing shop drawings, establish lines and levels for the work specified and check the Drawings to avoid interference with structural features and the work of other trades. Immediately call to the attention of the Architect any interference's for clarification in writing.
11. Sleeve seals: Product Data.

F. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions reviewed by the Engineer, or for deviations from requirements in the Contract Documents. Understand clearly that the Engineer's noting some errors but overlooking others does not grant the Contractor

permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

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 electrical 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. Prepare and submit a complete set of Construction Coordination Drawings utilizing the dimensions of the actual equipment to be utilized and indicating the exact routing for all elements such as piping, cable tray, conduit, ductwork, fire sprinkler lines, etc., including conduit embedded in concrete, and paying close attention to sloped plumbing lines such as sanitary and storm sewer. Use the architectural and structural drawings as the base drawings to which all trades shall add their work.

Provide Plan Views as well as sufficient Elevations and Sections to assure and demonstrate installation sequencing, access, and space coordination upon review. Complete each Coordination Drawing and include on the drawing sign-off by each individual trade performing work in the affected area, as well as the Contractor. No work shall commence in the area covered by the specific drawing until review and acceptance of drawing. This requirement for Coordination Drawings is not authorization for the Contractor or individual trades to make any unauthorized changes to the Contract Drawings. Maintain all Design Drawing space allocations such as ceiling heights (maintaining an eight (8) inch high zone directly above the ceiling for flexibility), chase wall dimensions, equipment room sizes, etc., unless prior written authorization is received from the Architect to deviate.

Work installed by a trade which interferes with work of any other trade will be corrected at no cost to the Owner.

1.6 SAFETY

A. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.

1.7 SCOPE OF WORK

A. Furnish all materials and equipment (except those items specifically stated in these Specifications or on the Drawings as being furnished by Owner or others), labor and incidentals required for the electrical work as indicated in these Specifications and Drawings and as required to make a complete and operating installation to the satisfaction of the Owner and the Architect.

B. Furnish competent supervision of the work to be performed at all times during the progress of the work. The work includes (but is not necessarily limited to) the following:

1. Service entrances and mounting of metering equipment as required by the Utility Company.
2. Connection to services from point of termination by Power Company
3. Main feeders and branch circuit wiring for lighting and power.
4. Emergency system.
5. Grounding.
6. Conduits and fittings.
7. Pull boxes and junction boxes.
8. Safety switches.
9. Panelboards.
10. Lighting fixtures.
11. Wiring devices.
12. Motor control equipment.
13. Variable Frequency Drives.
14. Lightning protection system.
15. Wiring and connections to equipment, which is to be furnished and installed under another division of these Specifications.
16. Installing, wiring, and connecting electrical equipment, which is to be furnished by the Owner.
17. Electrical work incidental to the requirements of the mechanical system.
18. Fire alarm system.
19. Raceway for commercial telephone system.
20. Temporary wiring as required for other building functions during performance of electrical work.

1.8 DRAWING

A. The Drawings shall serve to indicate the general layout of the various items of equipment. However, layout of equipment, accessories, specialties wireways, and conduit systems are diagrammatic unless specifically dimensioned, and do not necessarily indicate every required fitting, elbow, transition, junction box/ pull box, or similar items required for complete installation.

B. In electrical equipment rooms (area), drawings indicate electrical equipment selected to fit in the space(s) provided with due consideration given to code required clearances and work of other trades.

C. Contractor shall furnish submittals and shop drawings as hereinafter specified which reflect verification that the location and dimensions of all equipment are consistent with the spaces allocated, that coordination with installed piping and equipment of other trades has been accomplished, and that all required operating and code mandated clearances are complied with.

1.9 JOB CONDITIONS

A. Carefully investigate structural conditions, wall furring and chase locations, and room finishes and make actual measurements on the job so that all equipment such as panelboards switches, receptacles, lighting fixtures, fire alarm stations, horns, annunciators, and accessories shall fit. Practical consideration shall be given to coordination of all visible devices with aesthetic and architectural design elements.

B. Verify all measurements and be responsible for the correctness of same before ordering any materials or doing any work. No extra charge or compensation will be allowed because of any difference between the actual measurements and those indicated on the Drawings. Any difference, which might be discovered by the Contractor, shall be submitted to the Architect for consideration before proceeding with the work.

1.10 LAW AND PERMITS

A. The latest published enforced regulations of the State and Local Building Codes, National Fire Protection Association (NFPA) and National Electrical Code, with the latest tentative interim amendments, shall be considered as included in these Specifications, and all applicable requirements shall be fully complied with. Questions regarding interpretation shall be addressed to the Architect.

B. Apply for all permits, licenses, and inspection certificates and pay all fees incidental to the carrying on of the electrical work. Give notice to the proper authorities in ample time for the work to be inspected and approved as it progresses, and conceal no work until approved by the electrical inspectors having

jurisdiction. The National Electrical code and National Board of Fire Underwriters and all state and local rulings shall be observed and shall govern the character of this work. Should the Drawings or these Specifications in any way conflict with the Code, State, or local rules, promptly notify the Architect in writing in order that necessary changes can be accomplished by appropriate modification.

C. Upon completion of the installation, a certificate of approval from the electrical inspection department having jurisdiction thereon shall be furnished to the Owner, and all fees shall be paid by the Contractor. The certificate of inspection shall not release the Contractor from any guarantee or warranty obligations set forth in these specifications.

1.11 EXAMINATION OF PREMISES

A. Visit the site of the proposed work, inspect the facilities and become familiar with the difficulties and restrictions attending the execution of the Contract. No additional compensation for failure to be so informed will be allowed.

1.12 DISCREPANCIES

A. Written clarification shall be obtained before submitting a proposal for the Work under this Division as to discrepancies or omissions from the Contract Documents, or questions as to the intent thereof.

B. Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal and/or bid conveys full agreement of the items and conditions specified, shown on the Drawings, and required by the nature of the project unless specific written exceptions are provided with the proposal and/or bid documents.

C. Disparities between the drawings and the specifications shall be highlighted to the Architect for resolution.

D. Conflicting, incomplete or unclear drawings or specifications for equipment shall be highlighted to the Architect. A Contractor who assumes a direction or equipment description in the face of an unclear specification, shall clarify his assumption to the Architect so it may be confirmed prior to Bid and Equipment purchase.

1.13 GUARANTEE

A. All materials and workmanship shall be guaranteed for a period of one year, unless otherwise specified, from the date of acceptance of the project as substantially completed in accordance with the Drawings and specifications or when beneficially used by the Owner, whichever first occurs as certified by the

Architect. Defects due to faulty materials, methods of installation or workmanship shall be repaired or replaced promptly with the least inconvenience and without expense to the Owner, and at time designated by the Architect. This guarantee is in addition to any specific performance guarantees called for in the individual paragraphs.

B. Submit five copies of all warranties and guarantees for systems, equipment, devices and materials (this includes four copies for maintenance manuals).

1.14 ROYALTIES AND PATENTS

A. Hold and save the Owner harmless from any patent violations in connection with items of equipment, wiring devices, or material furnished and installed.

1.15 STANDARDS AND REGULATIONS

A. The work under this Division shall comply with the latest enforced edition of the applicable standards and codes of the following:

1. UL, Underwriters' Laboratories, Inc.
2. NEMA, National Electric Manufacturers Association
3. NEC, National Electrical Code 2011
4. Local and State Building Codes
5. ANSI, American National Standards Institute
6. IEEE, Institute of Electrical & Electronics Engineers
7. CBM, Certified Ballast Manufacturer
8. ASTM, American Society for Testing Materials
9. NFPA, National Fire Protection Association
10. IPCEA, Insulated Power Cable Engineers' Association
11. FM, Factory Mutual
12. ETL, Electrical Testing Laboratories
13. IES, Illuminating Engineering Society
14. OSHA, Occupational Safety and Health Administration
15. ASHRAE Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings
16. IBC, International Building Code
17. BICSI Telecommunications Distribution Design Manual

B. Include all items of labor and materials required to comply with such standards and codes. Where quantities, sizes or other requirements indicated on the Drawings, or herein specified are in excess of the requirements of the standards and codes, the Specifications and/or Drawings shall govern.

1.16 RECORD DRAWINGS

A. Upon completion of the project, furnish a complete set of the Drawings which will include all revisions/ sketches, etc., which may have been required during construction. The Contractor shall mark these Drawings, in red pencil, to indicate exact, as-installed conditions.

B. The as-installed conditions shall reflect any changes in equipment location or routing which did not follow that shown on the Contract Drawings. The changes in conduit and/or wiring sizes shall be indicated on these Drawings. During course of the installation, Contractor shall maintain a separate set of Drawings of marking and noting all installation deviations. This set of Drawings shall be maintained continuously, and shall be used for no other purpose than indicating as-installed conditions.

1.17 MAINTENANCE MANUALS

A. Submit four copies, including wiring diagrams maintenance and operating instructions, parts listings, and copies of all other submittals required by this Division 26. Organize each maintenance manual with Table or Contents, Index, and thumb-tab marked for each section of information. Bind in 2", three ring binders, vinyl covered, with pockets to contain folded sheets. Properly label contents on spine and face of binder.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless otherwise specified, all materials shall be new and unused and shall be listed by Underwriters' Laboratories, Inc., for the service intended.

2.2 COMPATIBILITY

A. Provide products which are compatible with other products of the electrical work, and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with other work. Determine in advance of purchase that equipment and materials proposed for installation will fit into the confines indicated, leaving adequate clearance as required by applicable codes, and for adjustment, repair, or replacement.

2.3 MANUFACTURERS' NAMEPLATES

A. Each major component of the equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code ratings, or other data which are die-stamped into the surface of the equipment shall be stamped in an easily visible location.

2.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Ensure that all electrical equipment, devices, and materials arrive at the site in good condition, intact in factory package or crate. Any equipment found to be damaged shall be removed from the project site.

B. Store all electrical equipment, devices, and materials in factory containers or package until ready for use. Storage facility shall be a clean, dry, indoor space which provides protection against weather. Avoid damage by condensation by providing temporary heating when required.

C. Handle all electrical equipment, devices, and materials carefully to prevent breakage, denting or scoring of the finish. Damaged materials shall be removed from the project site.

2.5 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.6 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 CUTTING, PATCHING AND PAINTING

A. Do all cutting and patching necessary for the installation of the work. Note that the integrity of any fire rated ceilings and/or ceiling-roof assemblies must be maintained. No cutting, drilling, or insertion of sleeves which may weaken a structural member shall be done without consent of the Architect. Finished floors, walls, and ceilings shall not be broken without consent of the Architect. Patching and repairs shall be made by the affected trades at the responsibility and cost of the Contractor.

B. All patching and painting shall be accomplished so as to match finished materials, paint/ or other finish to the satisfaction of the Architect.

3.2 WORKMANSHIP

A. Workmanship shall conform to the best electrical installation practice.

B. Equipment and accessories as installed shall be complete and operating. The exact location and arrangement of material and equipment shall be determined as work progresses to conform in the best possible manner with related work of other crafts. The work in all its details is subject to the approval of the Architect. Any work or material which is rejected must be removed and replaced immediately.

3.3 TESTS

A. Test all wiring to indicate that the completed system is free of short circuits and undesirable grounds and is ready for operation. Insulation resistance of all wiring shall meet the performance suggested by the manufacturer.

B. Provide all necessary testing equipment for making tests. All tests shall be made in the presence of the Architect or a representative thereof. When test results are not satisfactory, the Contractor shall make such adjustments and changes as are necessary and shall notify the Architect that he is ready for another test. Repeat the test or tests which disclosed the faulty or defective work or equipment, and make such additional tests as the Architect deems necessary.

C. Check direction of rotation of all motors and reverse connections as necessary. Contractor shall not attempt to "bump" motors while coupled to mechanical equipment that could be damaged by wrong rotation.

D. Contractor is to coordinate, furnish, and pay for all required and specified testing.

3.4 CERTIFICATES AND TEST REPORTS

A. Submit four copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems. Prior to conducting tests and certifications/ submit proposed test procedures and recording forms for review by the Architect. Necessary tests and certifications are described under the appropriate section of this Division 26 unless set forth herein below. Certifications and test reports to be submitted shall include but not necessarily be limited to:

1. Thermograph Testing: Conduct a thermograph test using an infrared temperature scanning unit. The test shall be performed by an independent testing laboratory (General Electric or Westinghouse Corporation Instrument Division). Connections indicating higher temperature levels than are acceptable shall be tightened or corrected as required to eliminate the condition. Conduct test, using test reporting forms, between six and eight months after beneficial occupancy, but in no case beyond the one year warranty period. Correct unacceptable conditions prior to end of the warranty period.
2. Combination Fire Alarm System, test for proper operation.
3. Wire and Cable Tests for Short Circuits and Insulation Resistance Values.
4. Grounding System Tests.
5. Ground Fault Protection System Test, including factory and field test results.

3.5 PROTECTION OF FIXTURES, MATERIAL AND EQUIPMENT

A. Continuously maintain adequate protection of stored materials and installed work. Fixtures and equipment, whether stored under a roof or outside shall be tightly

covered with sheet polyethylene or waterproof tarpaulin and protected against dirt, rust, moisture, chemical and mechanical injury. Materials and equipment shall not be stored directly on the ground nor in areas where they will be subject to physical injury from vehicular traffic or construction machinery. Contractor shall see to it that conduit and equipment installed by him is not used by other trades as supports for scaffolds or personnel. Delicate equipment shall not be delivered to the job site unless they can be placed in completed and protected areas. Conduit openings shall be capped or plugged during installation.

B. At the completion of the work, equipment, fixtures, exposed supports, and piping shall be cleaned to the satisfaction of the Architect.

3.6 ALLOWANCES

A. Make due allowance for relocating any lighting fixture, wiring device, disconnect switch, motor controller, panelboard or equipment item, prior to installation (whether furnished by the Contractor or by others and requiring electrical connections), a distance of 5'0" or less from the locations indicated on the Drawings without additional cost to the Owner.

3.7 CLEANING UP AND HOUSEKEEPING

A. At the end of each work day, remove all debris, surplus materials or foreign matter (caused by the performance of the electrical work) from the premises. On completion of the work, the Contractor shall be responsible for leaving the premises in a clean condition.

B. Keep stocks of material and equipment stored on the premises in a neat and orderly manner.

3.8 LINES AND LEVEL

A. Contractor shall be responsible for the lines and levels of the electrical equipment, wireways, and conduit systems based on reference lines and bench marks established by the Contractor for the general work.

3.9 TEMPORARY WIRING, LIGHTING AND POWER AT THE SITE

A. The Contractor shall be responsible for:

1. Furnishing and installing provisions for temporary lights and power during the construction period conforming to all Federal local code and State Labor Law requirements. Temporary light and power provisions to be included shall be as hereinafter specified.
2. Arrangements for temporary service with the Utility Company.

3. Furnishing, installing, and maintaining all temporary service equipment as required until permanent service is installed and "alive", and switch-over of temporary systems on the permanent service when latter is ready for same.
4. Furnishing, installing, maintaining, and switching on and off, on all regular working days a complete temporary light system for the building while under construction.
5. Furnishing, installing/ and maintaining temporary power to permanent mechanical equipment requiring service before permanent feeders are ready for same.
6. Providing any and/or all relocations of the temporary electric facilities as necessary to clear the permanent installations of all trades.
7. Providing all required lighting for stairways to meet the requirements of all authorities having jurisdiction.
8. Furnishing and installing all required lighting for Owner's signs.
9. Providing any temporary power for equipment space heaters.

3.10 WORK RELATED TO EQUIPMENT NOT FURNISHED AS WORK OF THIS DIVISION FOR SPECIFICATIONS

A. Unless specifically indicated otherwise any required electrical services for and required electrical connections to items shown on the Drawings and/or specified to be furnished in other divisions of the Specifications or by Owner shall be electrically connected as work of this section.

B. Electrical work for equipment specified in Division 23 Mechanical shall be as specified hereinafter.

C. Electrical work for equipment specified in Division 11 - Food Service Equipment shall be as specified hereinafter.

3.11 MECHANICAL EQUIPMENT

A. All power wiring associated with Division 23, Mechanical, shall be done as work of Division 26, Electrical. All power disconnect switches and single speed manual starting switches shall be furnished and installed as indicated under Division 26.

B. Except as may be indicated on the Drawings and/or hereinafter noted, all control wiring, including all temperature control wiring, interlocking, start-top wiring, together with conduit for same will be furnished and installed under Division 23. This includes, but is not limited to, wiring to low voltage thermostats, damper motors, aquastats, firestats, pushbuttons, selector switches, and control panel. All disconnect switches for control wiring shall be furnished and installed under Division 23.

C. Work of other divisions shall include furnishing and setting motors.

D. All magnetic starters will be furnished under Division 26, except for packaged equipment that will be furnished under another division of the Specifications. Overload elements in all starters shall be selected according to actual motor nameplate full load current. Responsibility for this coordination shall lie with the division under which the particular starter was furnished.

E. Firestats and wall mounted thermostats which interrupt line voltage power circuits to motors will be furnished and set under Division 23, and electrically connected in the branch circuit wiring as work of Division 26.

3.12 ELEVATORS

A. Connection from fire alarm control panel to each elevator controller, to signal an alarm condition shall be provided as work of Division 26.

B. Provide fused motor circuit switch capable of being locked in the open position for the auxiliary elevator circuit, per NEC 620-53. Locate this switch in the machine room/control room. Circuit serving cab lights shall have GFCI protection per NEC.

C. In connection with the elevator installation, provide:

a. Suitable light and GFI convenience outlets in machine rooms with light switch located within 18" of lock jamb side of access door.

b. A shunt trip circuit breaker shall be provided in the feeder circuit for the elevator motor and is to be located in the panel or switchboard indicated on construction drawings. The shunt trip device shall be activated by the elevator equipment room fire alarm system. Alternate: Provide a normal circuit breaker in location stated above and replace the disconnect switch in the elevator equipment room with a properly sized shunt trip circuit breaker in a NEMA I enclosure.

c. A 20 amp, 120 volt A.C. power supply for each elevator in the elevator machine room. Provide disconnect and extend circuit(s) to each controller.

d. A cab lighting outlet and circuit and telephone outlet or as required by the elevator system. Lighting circuit to have a toggle switch located next to elevator disconnect switch with an engraved face plate stating “Cab Lighting”.

e. A vapor tight lighting fixture in each pit (6’-0" ± above pit floor) and at the top of each shaft, which shall provide a minimum illumination level of five (5) footcandles at the pit floor, and a light switch so located as to be accessible from the pit access door.

f. A 15 amp, duplex GFI convenience outlet in each pit, 48"(±) above pit floor and at the top of each shaft.

g. Suitable wiring connection (in conduit), as required, between each elevator controller and the fire alarm control panel to provide signal to the controller to send all elevators down to first floor in case of fire alarm conditions.

h. Under Division 26, the solenoid valve (above the sprinkler head in the elevator machine room) shall be activated by the F.A. detector in the machine room or shaft. Upon activation of the machine room or shaft detector the F.A. system will allow a 30 seconds delay prior to activation of the detector signals to the shunt trip disconnect and the sprinkler solenoid valve.

3.13 WORK UNDER OTHER CONTRACTS

A. Incoming telephone service (conductors) to the telephone manhole or main telephone equipment room as indicated on drawings shall be by Local Telephone Company.

B. Furnishing and installing telephone wirings, instruments and equipment shall be by Local Telephone Company.

3.14 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.15 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.16 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.17 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

C. Cable, Wire and Connectors:

1. Provide cable, wire and connector work as shown, scheduled, indicated and as specified.
2. The applications for cable, wire, and connectors on the project are as follows:
   a. Power distribution circuitry
   b. Lighting branch circuitry
   c. Appliance, receptacle, and equipment branch circuitry
   d. Motor branch circuitry
   e. Special System wiring

D. Controls and Control Wiring:

1. The extent of miscellaneous electrical controls and control wiring work is as shown and scheduled, as indicated by the requirements of this Section, and as specified elsewhere in these Specifications.
2. The types of miscellaneous electrical controls and control wiring specified in this Section include, but are not necessarily limited to, the following:
   a. Miscellaneous Electrical Controls:
      a) Contactors

b) Relays
c) Photocells
d) Time Switches

b. Miscellaneous Control Wiring:
a) Capacitor control wiring
b) Fireman's ventilation override panel with interconnection wiring to the Fire Alarm Control panel
c) Additional control wiring and safety devices as shown and specified.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ANSI/NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation
4. Southwire Company.
5. Phelps Dodge.
6. ITT Royal Electric.
7. Simplex.
8. Anaconda.
9. Triangle Conduit & Cable Co.
10. Okonite.
11. Raychem.
12. Pyrotenax (For MI Cable Only)

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN & XHHW.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

E. General: Except as otherwise indicated, provide cable, wire, and connectors of manufacturer's standard materials, as indicated by his published product information, designed and constructed as instructed by the manufacturer and as required for the installation. Provide factory-fabricated wire and cable of the size, rating, material, and type as indicated for each use.

F. 600 Volt Building Cable and Wire: Provide soft or annealed copper wires meeting, before stranding, the requirements of ASTM B3, "Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes", latest edition.

1. All conductors shall be copper, single conductor heat and moisture resistant and thermal plastic insulated for all sizes, rated 600 volts, solid up to and including size #10, stranded thereafter unless specified or noted otherwise, except compact stranded aluminum may be used for conductor sizes 4/0 (copper equivalent) and larger with CU/AL rated bolted lugs for termination.
2. Lighting branch circuit wiring and motor control wiring shall be suitable for 75°C operating temperature, of types appropriate for dry or wet locations. Feeders, subfeeders and motor power wiring regardless of size shall be rated 600 volts and shall be suitable for 75°C operating temperature, of types appropriate for dry or wet locations.
3. Fixture wiring shall be 14 or 16 gauge, stranded, rated 600 volts and shall be suitable for 90°C operating temperature, (150°C under high temperature operating conditions) of types appropriate for dry or wet locations.
4. Control wiring operated at 120VAC and above shall not be smaller than #14AWG, and shall be copper, 98% conductivity, stranded with insulation rated not less than 60OV, and suitable for 75°C operating temperatures in wet and dry locations.

5. Control wiring operated at 50VAC or DC and less shall not be smaller than #16AWG, and shall be copper, 98% conductivity, stranded with insulation rated not less than 300V, and suitable for 75°C operating temperatures in wet and dry locations. Multiconductor wiring shall have an overall PVC jacket. Paired conductors shall be twisted and have 100% individual and overall shielding with copper drain wire and overall PVC jacket.
6. Conductors used for the transmission of data, sound, or video signals shall be copper, 98% conductivity, stranded, with insulation rated not less than 30OV, and suitable for 600C operating temperatures in wet and dry locations. Conductor size (AWG), construction (multipair, coaxial, etc.), and shielding shall be as specified by the manufacturer of equipment the conductors) are being connected to.
7. Unless otherwise specified, wire for the various services shall be of the following types:
   a. Branch power circuits: Type "THWN/THHN".
   b. Feeder: Type “THWN/THHN” or “XHHW”.
   c. Motor control wiring: Type "THWN/THHN”.

G. Mineral Insulated cable.

1. Conductor: solid high conductivity copper
2. Insulation Voltage Rating: 600 volts
3. Cable Temperature Rating: 90 degrees C
4. Termination Temperature Rating: 90 degrees C
5. Insulation Material: magnesium oxide
6. Sheath Material: magnesium oxide

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.
6. Thomas & Betts.
7. Burndy.

B. Provide factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Taps, Splices and Terminations:

1. All secondary feeder taps shall be made of cast copper, 2-bolt type connector, with insulating covers. Terminal connections shall be made with 2-bolt, clamp type lugs
2. Taps and splices for branch circuit wiring #14 to #6 shall be made with approved solderless pressure spring connectors with insulating covers as manufactured by:
   a. Minnesota Mining & Manufacturing Company
   b. Ideal Industries, Inc.
   c. Buchanan Electrical Products Corporation
3. Tape shall be Scotch #33 and shall be applied so that the insulation is not less than that of the wire.
4. Cable supports shall consist of composition cable clamps.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper for feeders No. 4 AWG and larger except compact stranded aluminum may be used for conductor sizes 4/0 (copper equivalent) and larger with CU/AL rated bolted lugs for termination. Solid copper for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway or Type MC where not used as a “home run” or not used where exposure to concrete chemical agents is possible.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway or Type MC where not used as a “home run” or not used where exposure to concrete chemical agents is possible.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Class 1, 2 Control Circuits: Type THHN-THWN, in raceway.

I. Two hour fire-rated installations: Enclose conduit and wire in two hour fire-rated assembly. Alternately, subject to specific acceptance by the Authority Having Jurisdiction for this individual project as obtained by the Contractor, Mineral Insulated cables may be utilized to provide two hour fire protection. Install Type MI Cable per NEC and manufacturer.

J. Insulation: Insulation shall meet or exceed the requirements of UL 83, "Standard for Thermoplastic Insulated Wires".

1. Insulation for conductors sized No. 18 AWG through No. 10 AWG shall be UL Type THHN/THWN.
2. Insulation for conductors sized No. 8 AWG and larger shall be UL Type THHN/THWN, or XHHW.
3. Branch circuit wiring within 3” of fluorescent ballasts shall be temperature rated for 90°C.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

E. Install electrical cable, wire, and connectors as shown, in accordance with the manufacturer's written instructions, the applicable requirements of NEC, the NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended functions.

F. All wire and cable shall be delivered to the job in complete coils or reels with the manufacturer's name and approved tag attached thereto, indicating wire size and type of insulation and with the National Fire Protection Association's approval.

G. All branch circuit wiring for lighting fixtures, wiring devices, etc., shall be provided as required to complete the installation, and shall be connected to panelboard branch circuits in accordance with panelboard schedules.

H. Branch circuit wire shall not be smaller than #12, however, control wiring may be #14 and shall be installed in continuous runs between terminal points, without splices.

I. Conductors for 20 amp branch circuits of 120 volts, more than 75 ft. long, (to the first fixture or other current-consuming outlet), and of 277 volt, more than 150 ft. long (to the first fixture or other current-consuming outlet) shall be No. 10-AWG.

J. Coordination: Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.

K. 600 Volt Building Wire and Cable:

1. Pull all conductors together when more than one is being installed in a raceway. Whenever possible, pull all conductors into their respective conduits by hand. Use pulling compound or lubricant when necessary; compound shall not deteriorate conductor or insulation.

2. Before any wire or cable is pulled into any conduit, thoroughly swab the conduit to remove all foreign material and to permit the wire to be pulled into a clean, dry conduit.

3. Run all feeders their entire length in continuous section without joints or splices.

4. Support all conductors in vertical raceways, as specified in Section 300-19 of the NEC.

5. Do not permit conductors entering or leaving a junction or pull box to deflect so as to cause pressure on the conductor insulation.

6. Make joints in branch circuits only where such circuits divide. These shall consist of one through circuit to which shall be spliced the branch from the circuit.

7. Make all splices and connections in control circuit conductors using UL approved solderless crimp connectors.

8. Make all grounding connections using ground clamps, connectors, or exothermic welds of a type suitable and UL approved for duty involved.

9. Powdered soap stone or other commercially produced wire lubricant may be utilized to ease wire pulling; however, any such lubricant shall be of a type to produce no deteriorating effect on conductor insulation or on the interior of associated wireway.

10. All secondary distribution feeders and branch circuit wiring #8 and smaller shall be factory color-coded in accordance with the following:

	120/208 Volt	277/480 Volt
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White or Grey	White or Grey
Ground	Green	Green

11. #6 and larger conductors may utilize 1" banks of appropriate colored tape. Control Wiring: All colors, except neutral wires shall be white or grey and ground wires shall be green.

12. Where conductors of same insulation characteristics carry unlike voltages and are installed in or pass through a common enclosure, such conductors shall be properly identified.

13. Where conductors are installed in or pass through a common enclosure, they shall be tagged to indicate clearly their circuit number, associated panel and destination. Tags shall be metal or fiber as hereinafter specified.

14. All control wiring shall be tagged at each termination point with a unique identification description used consistently throughout the wiring system. Tags shall be as manufactured by the Brady Company or approved equal.

15. Conductors used for the delivery of power to equipment at any voltage level and type shall not be installed in conduits carrying conductors used for any other purpose.

16. Conductors used for the transmission of data in a digital form shall be installed in conduit separate from all other conductors.

17. Conductors used for the transmission of analog signals shall be installed in conduit separate from all other conductors.

18. Conductors operating at a voltage of 120VAC and above shall not be installed in the same conduit as conductors operating at below 120VAC or DC.

19. Conductors of different systems shall not be mixed in the same conduit. For example, fire alarm system wiring shall be contained in its own conduit system and not in the conduit system of the building automation system, lighting system, etc.

20. In all cases, the requirements of the national electric code regarding voltage level of conductor insulation and their installation in conduits shall be adhered to.

21. Wire size (and conduit size-if required) shall be increased in diameter as required to maintain a 5-percent minimum voltage drop.

3.4 CONNECTIONS AND SPLICES

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. After a splice is securely "made-up", insulate entire assembly with UL approved insulating tape to a value equivalent to the adjacent insulation.

E. No tape or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make all taps and splices by the use of an approved type compression connector. Insulate all taps and splices equal to that of the adjoining wire. Make splices or taps only on such conductors as are of a component part of a single circuit, properly protected by approved methods.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials.

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL (TESTING DETAILS)

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors (100A or larger) for compliance with requirements.

2. Pre-Energization Check: Prior to energization, check cable and wire for continuity of circuitry and for short circuits. Correct malfunction when detected.

3. Feeder Insulation Resistance Test: Each main 600 volt feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination.

4. Tests shall be made using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC at 480v and 500VDC at 208V. Resistance shall be measured from conductor to conductor and from conductor to ground. Insulation resistance shall not be less than the 1000K OHMS.

5. Conductors which do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

E. Submittals: Contractor shall furnish all instruments and personnel required for tests. Submit four copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.

END OF SECTION

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SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide electrical service and equipment grounding as shown, scheduled, indicated, and specified.

B. The types of electrical service and equipment grounding specified in this Section include, but are not necessarily limited to, grounding all equipment and devices shown, and as required by the National Electrical Code (NEC), the State and Local Codes, Local Electrical Inspection Department and the Power Company.

C. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: As-Built Plans showing dimensioned locations of grounding features specified in Part 3 “Field Quality Control” Article, including the following:

1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.
4. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at ground rings, grounding connections for separately derived systems.
   a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
   b. Include recommended testing intervals.

1.4 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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 5/8" by 10 feet.

B. Concrete-Encased Electrode: bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than ½" in diameter, or consisting of at least 20 feet of bare copper conductor not smaller than 4 AWG.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

   1. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

E. Conductor Terminations and Connections:

   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Utility equipment to be grounded as per Entergy requirements. Ground pad-mounted equipment with underground cable to grounding service electrodes. Install tinned-copper conductor not less than No. 2 AWG.

C. Bond the case and neutral of each transformer directly to the nearest available effectively grounding structural metal member of the structure, the nearest available effectively grounded metal water pipe, or in accordance with the local electrical inspection department. Flexible conduit shall not be used as a ground path to a transformer.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

F. Grounding of all motors or equipment connected to terminal box with flexible conduit shall be made with separate grounding conductor between motor frame or equipment cabinet and rigid conduit system. Grounding conductor shall be sized in accordance with table 250-95 of the NEC.

3.4 INSTALLATION

A. Install grounding connections as shown and specified, in accordance with applicable portions of the NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended functions.

B. Connections shall be made with solderless pressure type connectors; and connectors shall be bolted or clamped to equipment and conduits.

C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

E. Main Bonding Jumper
   1. An unspliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the service-disconnect enclosure to the grounded conductor within the enclosure for each service disconnect and in accordance with NEC 250.28.
   2. Conductor shall be sized in accordance with NEC 250.24(C)(1).

F. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

G. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

H. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

I. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

J. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

K. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. Electrode shall be encased by at least 2 inches of concrete located horizontally near the bottom or vertically, and within that portion of a concrete foundation or footing that is in direct contact with the earth.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

L. Telecommunications Grounding

1. Within the base building electrical system cost, provide Telecommunications Grounding/Bonding System in accordance with NEC-250 and TIA/EIA-607, using approved grounding hardware. CAD weld bonding conductors to building steel.

2. Provide Telecommunications Main Grounding Busbar (TMGB) in Main Equipment Room (ER).
   a. All TMGB Connections to be made with double-bolted, compression style, grounding lugs
   b. As a minimum, Bond TMGB to following:
      1) Building Steel (minimum #2 AWG insulated copper bonding conductor)
      2) Main Electrical Service Ground (minimum #2 AWG insulated copper bonding conductor).
      3) Local Service Panel Ground (minimum #4 AWG insulated copper bonding conductor).
      4) Telecommunications Bonding Backbond (TBB) that connects TMGB to other TGBs (minimum #2 AWG insulated copper bonding conductor).
      5) Associated Telecommunications Cable Tray(s) (minimum #6 AWG insulated copper bonding conductor).
      6) Telecommunications Conduit(s) Entering ER (minimum #6 AWG insulated copper bonding conductor).

3. As a minimum, the Technology Contractor shall bond the following devices to the associated TMGB and TGBs using a minimum #4 AWG insulated copper bonding conductor using compression style lugs:
   a. PABX Equipment
   b. Equipment Racks and Cabinets.
   c. TR Cable Ladder and Tray
   d. CATV Equipment
   e. Lightning and Surge Protectors
   f. Telecommunications Devices
   g. Coupled Bonding Conductors (CBCs)
   h. Backbone Cable Shields
   i. Telecommunication and Fiber Cable Shields
   j. Antenna Cable Shields

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

B. The main facility grounding field electrode system to ground shall be 5 ohms or less.

C. Notify Architect promptly if any excessive Ground Resistance values are measured and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section “Vibration Controls For Electrical Systems” for products and installation requirements.

C. Provide concrete, pedestals, bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, hangers, channels, cradles, saddles, etc. for installation of equipment and apparatus shown on the Drawings and specified in the various sections of this Division 26, Electrical.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Refer to Division 07 Section “Roof Accessories.”

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for cables in riser conduits.

Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural steel shapes, shop, or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section “Metal Fabrications” for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

F. Pipe straps and hanger rods shall be fastened to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Wooden plugs and shields shall not be used for fastening pipe strips and hangers.

G. Vertical runs of conduit in cores and closets shall be supported at every floor; support intervals must not exceed 14 ft.

H. Under no circumstance shall the ductwork, piping and mechanical equipment be used for supporting electrical facilities.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section “Metal Fabrications” for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

D. Concrete pads for floor mounted electrical equipment shall be 4” high, unless otherwise indicated, poured integral with the floor slab wherever practical. Wherever integral slab poured pads are not practicable, construct 4 inch high housekeeping pads, reinforced with No. 3 steel wire mesh 6 x 6 inches, fastened to structural slabs with ½ inch diameter bolts embedded in structural slabs with expansion bolts at all corners (inset 3 inches) and no further apart than 18 inches, score structural slab thoroughly to assure concrete bonding between structural slab and housekeeping pad.

E. Finish tops of housekeeping pads smooth and level within 1 percent of span. Pads shall be extended at least 4" beyond the equipment outline on all four sides.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Provide electrical raceways and fitting work, wiring gutters, electrical box and fitting work as shown, scheduled, indicated and as specified.

C. The types of electrical raceways and fittings for the project include the following:

1. Rigid steel
2. Electrical metallic tubing (EMT)
3. Flexible metal conduit
4. Liquidtight flexible metal conduit
5. Rigid non-metallic conduit
6. PVC coated rigid steel conduit

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

A. General: Provide metal and non-metallic conduit, tubing, and fittings of the type, grade, size, and weight (wall thickness) as shown and required for each service. Where type and grade are not indicated, provide proper selection to fulfill the wiring requirements and complying with the NEC for electrical raceways.

B. Conduit shall be provided in standard 10-ft. lengths, each length bearing the Underwriters' Laboratories label. Conduit shall not be smaller than 1/2" except where noted otherwise.

C. Couplings, connectors, and fittings shall be approved type specifically designed and manufactured for the purpose. UL Label: All electrical raceways and fittings shall be UL labeled.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1, hot dip galvanized.

B. Rigid Steel Fittings: ANSI C80.4.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. EMT: ANSI C80.3, galvanized.

E. EMT Fittings: ANSI C80.4, galvanized.

F. FMC: Zinc-coated steel.

G. Liquidtight Flexible Metal Conduit (LFMC):

1. Type: Single strip, continuous, flexible, interlocked, double-wrapped steel, galvanized inside and outside; forming smooth internal wiring channel; with liquidtight jacket of flexible PVC.
2. Liquidtight Flexible Metal Conduit Fittings: Liquidtight, zinc-coated steel.

H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
3. Fittings for EMT: compression.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

J. The exterior and interior surfaces of all rigid steel conduit and steel electrical metallic tubing shall be thoroughly and evenly protected against corrosion with a zinc coating. The galvanized protection shall be coated with either a lacquer or enamel finish both inside and outside.

K. Manufacturers: Subject to compliance with requirements, provide products produced by one of the following (or equal):

1. Rigid Steel:
   a. Allied Tube & Conduit Corp.
   b. Jones & Laughlin Steel Corp.
   c. Republic Steel Corp.
   d. Triangle PWC, Inc.
   e. Youngstown Sheet & Tube
2. EMT:
   a. Allied Tube & Conduit Corp. Anaconda Co.
   b. ETP-Uni-Couple
   c. Jones & Laughlin Steel Corp.
   d. Republic Steel Corp.
   e. Triangle PWC, Inc.
   f. Youngstown Sheet & Tube
3. Flexible Metal and Liquidtight Flexible Metal:
   a. Anaconda Metal Hose
   b. Electri-Flex Co.
   c. Flexi-Guard, Inc.
   d. Triangle PWC, Inc.
4. Non-Metallic Conduit:
   a. Certainteen
   b. Cantex
   c. Picoma
   d. Sceptor
   e. Carlon
5. Raceway Fittings:
   a. Amoco Chemicals Corp.
   b. Appleton Electric Co.
   c. Carlon
   d. Crouse Hinds
   e. Efcor Division
   f. ETP-Uni-Couple
   g. O.Z. Gedney Co.
   h. Raco, Inc.
   i. Republic Steel Corp.
   j. Steel City

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.4 ELECTRIC GUTTERS

A. Provide hinged galvanized steel electrical gutters in the types and sizes indicated, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards.

B. Provide size as indicated. Where size is not indicated, construct in accordance with NEC and other applicable standards.

C. Provide gutter accessories where indicated, constructed of same metal and finish as gutters.

D. Provide gutter supports where indicated, conforming to the NEC, as recommended by the manufacturer.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

C. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

D. Boxes:

1. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Provide "Gang" boxes where devices are shown to be grouped.

2. Type for Various Locations:
   a. Ceilings: 4” square or 4" octagonal, 2-1/8” deep.

b. Plaster Walls: 4” square, 2-1/8” deep, with raised plaster cover to fit thickness of sheet rock wall set with face approximately 1/8" from finished surface. Furnish shallow boxes where necessary.
c. Dry Wall Construction Walls: Standard galvanized switch box, 2-1/8 " deep. Furnish shallow boxes where necessary.
d. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be properly coordinated for each specific installation.
e. Surface: Type FS or FD box with surface cover.
f. Special: Where above types are not suitable, furnish boxes to suit the use taking into account space available, appearance, and Code requirements.

3. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including proper covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for all boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

4. Weatherproof Outlet Boxes: Provide hot dipped galvanized cast iron weatherproof outlet wiring boxes, or the type, shape, and size, including depth of box, with threaded conduit ends, fiberglass reinforced cover plate with spring-hinged waterproof caps suitably configured for each application, including face place gasket corrosion-resistant fasteners.

5. Junction and Pull Boxes: Provide 14 gauge, galvanized welded sheet steel junction and pull boxes, with screw-on covers, of the type, shape, and size, to suit each respective location and installation.

6. Type for Various Locations:
   a. 100 Cubic Inches in Volume or Smaller: Standard outlet boxes with stamped knockouts.
   b. 150 Cubic Inches in Volume or Larger: Code gage steel with sides formed and welded, screw covers unless shown to have hinged doors. Hinged doors with locking device same as furnished on panelboards. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
   c. Exterior or Wet Areas: Weatherproof galvanized steel construction with proper gaskets and corrosion resistant fasteners.

7. Conduit Bodies: Provide galvanized cast metal conduit bodies, of the type, shape, and size, to suit each respective location and installation, constructed with threaded conduit ends, removable cover, and corrosion-resistant screws.

8. Bushings, Knockout Closures, and Locknuts: Provide corrosion resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of the type and size to suit each respective use and installation.

2.6 SLEEVES FOR RACEWAYS

A. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.7 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit RMC.
3. Underground Conduit: Schedule 80 PVC for service entrance conductors, Schedule 40 PVC for branch circuit conductors.
4. Connection to Vibrating Equipment (Including Transformers Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT or Type MC cable (Section 260519).
5. Connection to Vibrating Equipment Including Transformers and Hydraulic, Pneumatic, or Motor-Driven Equipment: FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 12 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping. Keep raceways at least 6 inches away from cross-runs and at least 3” away from cold water piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of four 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Subject to obtaining prior approval by Structural Engineer for the specific location it is acceptable to run conduit up to and including 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. PVC conduit may be utilized.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change to rigid steel conduit, before rising above the floor.

I. All conduit run beneath slab on grade or fill, and extending 5 feet beyond building perimeter, shall be rigid steel and shall utilize fittings rated both “concrete tight” and “watertight”. Conduit shall be supported with stainless steel hangers 5 ft. o.c. from the building slab. Alternatively, PVC conduit may be utilized with rigid steel

elbows (for bends 45° or more) and with rigid steel slab penetrations provided hangers are stainless steel and at a maximum 4-foot on center spacing.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

M. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

N. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Complete raceways or enclosures shall be provided for conductors throughout all systems specified. Equipment and devices purchased by the Contractor which are not constructed with housings for mounting and enclosing all live parts, shall be installed in metal cabinets. All equipment, enclosures, raceways, etc. shall be

appropriate for the atmospheres and hazards encountered within their associated areas.

R. Conduit extending into positive pressurized plenums within mechanical equipment (ie. Air handling units, outside air units, fan coils, VAV, etc.) shall be sealed on the outside of the unit to prevent cold air entry. Seal around cables within a J-box with 'duct seal'.

S. Conduit run exposed on building roofs shall be supported on prefabricated conduit supports with conduit clamps spaced on 6 foot (maximum) centers.

T. Where PVC is used, contractor shall provide ground wire(s) sized in accordance with Article 250-94 or 250-95 of the NEC.

U. If conduit runs from point to point exceed 150 ft. in length or exceed total bend limitations, provide pull boxes in locations accessible at all times.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Underground Conduit:

1. Excavation and Backfilling:
   a. Excavation and backfilling of trenches required for the installation of all electrical services and underground wireways and conduit systems within the building, and for connection with exterior underground electrical services outside of the building, shall be performed by the Contractor for his work as shown and noted on Drawings and as specified.
   b. Trenching: Excavate to the required depths and grade, the bottoms of trenches to secure the required slope for conduit as hereinafter specified. Rock or existing concrete, where encountered, shall be excavated to a minimum depth of 6" below the bottom of conduit(s). Where mud or otherwise unstable soil is encountered in the bottom of the trench which is incapable of supporting the conduit(s), such soil shall be removed to firm bearing and the trench shall be backfilled with sand to the proper grade and tamped to provide firm, uniform support.
   c. Excavate trench bottom to provide firm and uniform support for concrete envelope. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
   d. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

e. Where machines are used to excavate trenches, such machine excavation shall terminate 3" above the bottom of conduit or duct. Final excavation and shaping of the trench shall be performed by hand to provide a firm, uniform bearing. Trench bottoms shall be graded to provide continuous slope of conduit or duct runs between manholes or from building to manholes and shall at all times be of sufficient depth to provide for a minimum cover of 30 inches over the top of the duct, conduit or concrete envelope measured from the existing ground surface or the indicated finish grade, whichever is lower.

f. Pumping and Draining: Contractor shall be responsible for the pumping and draining of trenches or pits necessary for the installation of its work.

g. Backfilling: The trenches shall not be backfilled until the conduit has been tested by the Contractor and reviewed by the Architect and/or any local authorities having jurisdiction thereof. Backfill consisting of sand or selected excavated material shall be placed to a depth of one foot above the top of the conduit or pipe and compacted by hand tamping. Backfill for the remainder of the trench shall be placed using excavated materials compacted as required to produce the same density of the soil in the surrounding areas.

2. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   1) Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   2) For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

4. Warning Planks: Bury warning planks approximately 12 inches above, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve

seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 INSTALLATION OF BOXES AND FITTINGS

A. Install electrical boxes and fittings as shown, in compliance with NEC requirements, or in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes and fittings serve the intended purposes.

B. Outlet boxes above suspended ceiling shall be installed adjacent to each recessed fixture in such manner as to be accessible through the opening in the ceiling in which the fixture is installed. All outlets for the attachment of fixtures shall be provided with fixture studs securely anchored to the boxes.

C. Outlets in glazed tile walls shall be similar with opening in tile carefully cut so that opening will be amply covered by the device plate.

D. Outlets for surface mounted receptacles, switches and telephones shall be the FS type.

E. Use outlets and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes may be located.

F. Determine from the Drawings and by actual determination on the site, the exact location of each outlet. The outlet locations shall be modified from those shown to accommodate changes in door swings or to clear other interferences that may arise from job construction details, as well as modification to center them within room spaces. These modifications shall be made with no change in contract price and shall be a matter of job coordination. Check these conditions through out the entire job and notify the Architect of discrepancies, as they may occur, to verify the modifications, if any, before proceeding with the installation of the work. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required to extend boxes to the finished surfaces of special furring or wall finishes.

G. Where indicated in the Drawings and Specifications or where necessary for compliance with manufacturer's recommendations and/or code requirements for cable installation, provide junction and pull boxes of the proper sizes.

H. Where boxes are set flush in walls and ceilings, cover screws shall be flat head type properly countersunk. Covers shall be arranged to completely cover openings in the building finish.

I. Where suitable, standard outlet boxes may be used as junction and pull boxes.

J. On exposed conduit systems provide pull boxes, junction boxes, wiring troughs, and cabinets wherever necessary for proper installation of various electrical systems.

K. Provide junction and pull boxes for feeders and branch circuits where shown and where required by the NEC, regardless of whether boxes are shown or not.

L. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.

M. Provide knockout closures to cap unused knockout holes where blanks have been removed.

N. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

O. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

P. Boxes for any conduit system shall not be secured to the ceiling system, HVAC duct work, or mechanical piping.

Q. Coordinate locations of boxes in fire rated partitions and slabs so as to not affect the fire rating of the partition or slab. Notify the Architect in writing where modifications or additional construction are required to maintain the partition or slab fire rating.

R. Paint fire alarm boxes red above suspended ceilings and in exposed areas.

S. Identify all junctions, outlets or pullboxes. Label or mark coverplates indicating system served such as "SIG" for signal, "TEL" for telephone or PNL-A 2, 4, 6 for panel designation and branch circuits 2, 4, 6.

3.7 INSTALLATION OF ELECTRICAL GUTTERS

A. Install gutters where shown, in accordance with the manufacturer's written instructions, NEC, NECA's "Standard of Installation" and with recognized industry practices to ensure that the gutters comply with the specified requirements and serve the intended purposes. Comply with requirements of NEMA and the NEC pertaining to installation & sizing of electrical gutters.

B. Indoor gutters shall be hinged on one side.

C. Remove burrs and sharp edges of gutters wherever these could possibly be injurious to wiring insulation or jacket.

D. Complete gutter installation before starting the installation of cables.

E. Provide sufficient space to permit access for installation, splicing and maintaining the cables.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.9 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 0548

VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Welding certificates.

C. Qualification Data: For professional engineer.

D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

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SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Warning labels and signs.
2. Instruction signs.
3. Equipment identification labels.
4. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.2 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

3.2 FLASH PROTECTION

A. Switchboards, panelboard, industrial control panels, and meter socket enclosures that require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

B. Based on the results of the Incident Energy Study (Arc Flash Study – see Section 26 05 73), the supplier shall produce and install a warning label (orange) or danger label (red) for each piece of equipment as specified in "Section A" in accordance with ANSI Z535.4-2002. The label must be readable in both indoor and outdoor environments for at least 3 years and contain the following information:

1. Arc hazard boundary (inches)
2. Working distance (inches)
3. Arc flash incident energy at the working distance
4. PPE category and description including the glove rating
5. Voltage rating of the equipment
6. Limited approach distance (inches)
7. Restricted approach distance (inches)
8. Prohibited approach distance (inches)
9. Equipment/bus name
10. Date prepared
11. Supplier name and address

3.3 IDENTIFICATION SCHEDULE

A. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

B. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

C. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting,

control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Stenciled legend 4 inches high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards
   e. Emergency system boxes and enclosures.
   f. Enclosed switches.
   g. Enclosed circuit breakers.
   h. Enclosed controllers.
   i. Variable-speed controllers.
   j. Push-button stations.
   k. Power transfer equipment.
   l. Contactors.
   m. Remote-controlled switches, dimmer modules, and control devices.
   n. Power-generating units.
   o. Monitoring and control equipment.

   Coordinate with Architect for labeling of access panels in finished areas and adjust work accordingly.

3.4 SERVICE ENTRANCE EQUIPMENT

A. A sign shall be placed at the service-entrance equipment, indicating type and location of on-site emergency power source.

B. Provide a sign to be located at the service entrance equipment in compliance with NFPA 70:701.7(B) to read, “WARNING: SHOCK HAZARD EXISTS IF GROUNDING

ELECTRODE CONDUCTOR OR BONDING JUMPER CONNECTION IN THIS EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE IS ENERGIZED."

C. Service equipment shall be legibly marked with the maximum available fault current. Include the date the fault current calculation was performed.

END OF SECTION

SECTION 26 0573

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1. Coordination of series-rated devices is permitted.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.
4. Incident Energy Study Report (Arc Flash Study).

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:

B. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall

demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

    a. Arcing faults.
    b. Simultaneous faults.
    c. Explicit negative sequence.
    d. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. All devices are to be coordinated and shown on Drawings.

    1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

    1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
    2. Impedance of utility service entrance.
    3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

        a. Circuit-breaker and fuse-current ratings and types.
        b. Relays and associated power and current transformer ratings and ratios.
        c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
        d. Generator kilovolt amperes, size, voltage, and source impedance.
        e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
        f. Busway ampacity and impedance.
        g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

    1. Distribution panelboard.
    2. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141 or IEEE 241 and IEEE 242.

1. Transformers:

    a. ANSI C57.12.10.
    b. ANSI C57.12.22.
    c. ANSI C57.12.40.
    d. IEEE C57.12.00.
    e. IEEE C57.96.

2. Medium-Voltage Circuit Breakers: IEEE C37.010.
3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
4. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium- voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. The contractor, in conjunction with the distribution and protective equipment manufacturer, shall be responsible for proper protective equipment coordination. A complete coordination study shall be submitted for approval indicating selectivity and coordination between the different levels of protective devices in the system and the Power Company protective devices.

B. The Coordination shall include:

1. Short Circuit Study: This study shall show the momentary and interrupting fault duties on each bus shown on the single-line diagram. Calculation of faults throughout the power distribution system. In addition, an impedance values reduced to a common MVA base referenced to a single-line diagram for ease in

reviewing data. Study each fault interrupting device related to the calculated duty and recommend changes when appropriate.

2. Coordination Study: This study shall be a comprehensive protective device coordination study covering all devices identified on the single-line diagram. Using a practical compromise between protection of electrical equipment and coordination of devices "downstream", provides settings for all adjustable protective devices shown on the diagram. Prepare time/current coordination curves to illustrate the protection and coordination achieved with the recommended settings of protective devices. These curves shall reflect the following (where applicable):
   a. Appropriate NEC Protection points
   b. Appropriate ANSI Protection points
   c. Motor start-up current points
   d. One-line diagram of the system identifying the device plotted
   e. Short circuit current levels used for coordination
3. Implementation: The contractor shall make the proper changes to the overcurrent and protective devices he intends to use in accordance with the recommendations included in the executive summary of his report, including changes to conductor types and sizes, after approval from the Architect, without additional cost to the owner.

C. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

D. Comply with IEEE recommendations for fault currents and time intervals.

E. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

   a. Inrush current when first energized.
   b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
   c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

F. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

G. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

H. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

   a. Device tag.
   b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
   c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
   d. Fuse-current rating and type.
   e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

   a. Device tag.
   b. Voltage and current ratio for curves.
   c. Three-phase and single-phase damage points for each transformer.
   d. No damage, melting, and clearing curves for fuses.
   e. Cable damage curves.
   f. Transformer inrush points.
   g. Maximum fault-current cutoff point.
   h. Completed data sheets for setting of overcurrent protective devices.

3.5 INCIDENT ENERGY STUDY (ARC FLASH STUDY)

A. An incident energy study shall be done in accordance with the IEEE 1584-2004a, “IEEE Guide for Performing Arc Flash Hazard Calculations” as referenced in NFPA 70, “Standard for Electrical Safety in the Workplace”, 2004 Revision, in order to quantify the hazard for selection of personal protective equipment (PPE). Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable.

B. The supplier shall supply a comprehensive report that includes:

1. Incident energy level (calories/cm2) for each equipment location and recommended PPE.
2. Overcurrent device coordination curves including related section of the single-line diagram.

C. Safety Training: The supplier shall provide one day of arc flash safety training that contains the requirements referenced in OSHA 1910.269, OSHA 1910 Subpart S and NFPA 70E. This shall include:

1. Proper use of the system analysis data.
2. Interpretation of hazard labels.
3. Selection and utilization of personal protective equipment.
4. Safe work practices and procedures.

END OF SECTION

SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Exterior photoelectric switches
2. Indoor occupancy/vacancy sensors
3. Programmable lighting controllers/panels
4. Digital occupancy/vacancy sensors
5. Digital switches
6. Handheld remotes for personal control
7. Digital room controllers
8. Configuration tools

B. Related Sections include the following:

1. Division 16 Section "Wiring Devices" for manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: Catalog sheets, specifications, and installation instructions for each type of product indicated.

B. Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
2. Provide scale drawings indicating all sensors, controllers, and device locations.

C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 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. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturer's defects.

1.8 SYSTEM DESCRIPTION & OPERATION

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is the intent of this section to provide an integrated, energy saving lighting control system including Lighting Control panels, Occupancy Sensors, and Daylighting Controls.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Hubbell

2. Cooper Controls/Greengate, Inc.
3. Sensor Switch, Inc.
4. Wattstopper
5. Lutron
6. Leviton
7. Douglas Lighting Controls
8. ILC – Intelligent Lighting Controls, Inc.
9. Novitas, Inc.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Description: Solid state, with SPST or DPST dry contacts rated for 1800-VA, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 DIGITAL SINGLE/DUAL RELAY WALL SWITCH OCCUPANCY SENSORS

A. Passive Infrared (PIR) wall switch occupancy sensor: Manual-ON, Automatic-OFF. Furnish the Company's model # which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled. Basis of Design: WattStopper PW Series.

B. Ultrasonic wall switch occupancy sensor: Manual-ON, Automatic-OFF. Furnish the Company's model # which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled. Basis of Design: WattStopper UW Series.

C. Dual Technology (passive infrared and ultrasonic) wall switch occupancy sensor: Manual-ON, Automatic-OFF. Furnish the Company's model # which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled. Basis of Design: WattStopper DW series.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton programming for the following variables:
   a. Sensitivity – 0-100% in 10% increments
   b. Time delay – 1-30 minutes in 1 minute increments
   c. Test mode – Five second time delay
   d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   e. Walk-through mode
   f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
2. One or two RJ-45 port(s) for connection to DLM local network.
3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
4. Device Status LEDs including:
   a. PIR Detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. Basis of Design: WattStopper LM Series.

2.5 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; compatible with wall plates with decorator opening. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Red configuration LED on each switch that blinks to indicate data transmission.
4. Blue Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network (panel, other switches, and/or occupancy sensors).

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

D. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to Toggle, On only or Off only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

E. Basis of Design: WattStopper LMSW series.

2.6 HANDHELD REMOTE CONTROLS

A. Battery-operated handheld switches in 1, 2 and 5 button configuration for remote switching or dimming control. Remote controls shall include the following features:

1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
2. Blue LED on each button confirms button press.
3. Load buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

4. Inactivity timeout to save battery life.

B. Provide one remote control unit in each of the electrical rooms.

C. A wall mount holster and mounting hardware shall be included with each remote control.

D. Basis of Design: WattStopper LMRH Series.

2.7 ROOM CONTROLLERS

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
3. Device Status LEDs to indicate:
   a. Data transmission
   b. Device has power
   c. Status for each load
   d. Configuration status
4. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
5. Plenum rated
6. Manual override and LED indication for each load
7. Dual voltage (120/277 VAC, 60 Hz)
8. Zero cross circuitry for each load.

B. On/Off Room Controllers shall include:

1. One or two relay configuration
2. Efficient 150 mA switching power supply
3. Three RJ-45 DLM local network ports
4. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
   a. One relay configuration only
   b. Automatic-ON/OFF configuration
5. Basis of Design: WattStopper LMRC-101, LMRC-102, LMPL-101.

C. On/Off/Dimming enhanced Room Controllers shall include:

1. Real time current monitoring
2. One, two or three relay configuration
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports.
5. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
6. Optional Network Bridge for BACnet MS/TP communications (LMRC-3xx).
7. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100%
   b. Set high and low trim for each load
   c. Set lamp burn in time for each load up to 100 hours
8. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
   a. One relay configuration only
   b. Automatic-ON/OFF configuration
9. Basis of Design: WattStopper LMRC-211, LRMC-212, LRMC-213, LMPL-201, LMRC-311, LMRC-312, LMRC-313.

2.8 ROOM NETWORK (DLM Local Network)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 6A cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:

1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.9 CONFIGURATIONS TOOLS

A. A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include:

1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s)on the local network, and incorporate those levels in scene setting.
6. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

C. Basis of Design: WattStopper LMCT-100, LMCI-100/LMCS-100

2.10 INDOOR OCCUPANCY/VACANCY SENSORS

A. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit (as required).

1. Operation: Unless otherwise indicated, turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 20 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70. Use plenum cable when required.
4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. All components shall be UL Listed and offer a five (5) year warranty.
8. Passive Infrared and Dual Technology sensors shall have fully automatic operation,–be able to accommodate dual level lighting as required.
9. Control units:
   a. Control units shall be isolated.
   b. For ease of mounting, installation and future service, control unit(s) shall be able to be mounted on external J boxes and be integrated self-contained unit consisting internally of load switching control relay and a transformer to provide low-voltage power to a minimum of two (2) sensors.
10. Between sensors and control units shall be three (3) conductors, 18 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable approved for use in plenums.
11. Contractor is responsible for field verification of required number of power packs:
    a. One power pack is required for each controlled circuit.
    b. Each power pack can supply up to 150MA. Refer to installation guide for maximum number of sensors connected to power pack.
    c. If multiple circuits are to be controlled by a single sensor, auxiliary relays may be used in conjunction with a power pack.

B. Provide vacancy sensors as indicated on construction drawings, as hereinafter specified or as recommended by the manufacturer.

1. Wall mounted PIR sensor switch: Mount on wall at strike side of door. Use in the following locations:
   a. Small offices with one lighting load
   b. Individual restrooms
   c. Small break rooms with one lighting load
   d. Small conference rooms with one lighting load
2. Wall mounted Ultrasonic sensor switch. Mount on wall at strike side of door. Use in the following locations:
   a. Small storage rooms
   b. Small utility rooms
   c. 2-stall restrooms
3. Wall mounted PIR sensor switch (with dual relays for inboard/outboard switching). Mount on wall at strike side of door. Use in the following locations:
   a. Small offices with more than one lighting load
4. Wall mounted dual technology sensor switch (with dual relays for inboard/outboard switching). Mount on wall at strike side of door. Use in the following locations:
   a. Small/medium workrooms/lounges
   b. Small/medium conference rooms with more than one lighting load

5. Ceiling/Wall mounted dual technology sensor. Mount in corner of room as shown on drawings. Use in the following locations:
   a. Classrooms
   b. Large conference rooms and offices with suspended lights
6. Ceiling mounted ultrasonic sensor. Mount on ceiling in middle of rooms as shown on drawings. Use in the following locations:
   a. Group restrooms
   b. Large storage rooms
   c. Corridors
   d. Open offices
7. Where occupancy/vacancy sensors are located in wet or damp locations, such as in locker rooms and shower areas, provide a sensor with gasketed, watertight enclosure, which prevents moisture and dust from entering the sensors and affecting occupancy detection.

C. PIR Type: Wall-or Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

D. Ultrasonic Type: Wall-or Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.
6. Ultrasonic microphone receiver frequency shall be 32 KHz or greater and be temperature and humidity resistant.

E. Dual-Technology Type: Wall-or Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.11 PROGRAMMABLE LIGHTING CONTROLLERS

A. Where shown on the drawings, the contractor shall furnish and install a programmable lighting control system consisting of programmable lighting controllers, switches and other devices in the quantities, sizes and types shown on the drawings and specified herein.

B. Programmable lighting controllers shall contain relays and other devices of the sizes and quantities indicated on the drawings and specified herein.

C. Hardware Features:

1. Controller Back-Box: Each programmable lighting controller shall be provided with a factory furnished; UL listed NEMA 1 enclosure designed for wall mounting.
2. Line Voltage / Control Voltage Separation: Each programmable lighting controller shall be provided with a mechanical barrier that separates all line voltage components and wiring from all control voltage components and wiring.
3. Controller Covers: Each programmable lighting controller shall be provided with a hinged locking removable cover that is designed for either surface or flush mounting.
4. Controller Capacity/Configurations: Controllers shall be available in sizes to accommodate 4, 8, and 16 relay outputs and inputs.

D. Electrical:

1. Controller Power Supply: Each programmable lighting controller shall be provided with a dual-rated, UL listed Class 2 transformers capable of either 120 or 277 VAC primary (50 to 60 Hz). It shall contain an internal self-resetting fuse. Provide 120V, 20A circuit to each power supply, as required. Connect to spare 1P, 20A CB in nearest panel.
2. Connections: All connections shall be made to clearly and permanently labeled termination points.

E. Controller Electronics:

1. Controller CPU: Each programmable controller shall be provided with a CPU (Central Processing Unit) that shall provide all the programming and control functions for the entire controller network. CPU shall be protected against loss of memory during a power outage through nonvolatile RAM for a period of up to 50 years without power of any type. The power input shall be protected against surges and transients.
2. Real-Time Clock: Real-Time Clock shall be used to perform all time-controlled functions. Clock accuracy shall be displayed to the second. Real-Time Clock functions shall include time of day, day of week, date and automatic daylight savings and leap year adjustments. Time clock shall be protected against loss of time during a power outage for a period of up to 45 days without power of any type.
3. Inputs: Each controller shall be provided with 1 input board containing 4 inputs. It shall also be capable of adding boards to match the total number of outputs. Electronics shall feature surge protection and opto-isolation.
4. Outputs: Each controller shall be provided from 1 to 4 output boards containing 4 outputs depending on enclosure size. Electronics shall feature surge protection and opto-isolation.
5. Switch Input Characteristics: Each switch input shall be designed to be actuated by dry contact from 2 or 3 wire momentary or maintained switches or their logical equivalents (Photo-cell contacts, Building Automation System Outputs, Time clocks etc.)
6. Programmable Pilot Output: The LEDs shall reflect the true status of the relay controlled by the switch input. These Pilot LEDs shall track the status of the affected relays. (If the switch turns on relay output 5 for example, relay 5 output LED will light.) However the user shall have the option of programming the LED to indicate the status of any relay, group or preset.
7. Relay Output Characteristics: Each Relay Output shall control an electrically held lighting relay rated for 120 VAC @ 20 full load amps.
8. Communications: The controller shall be equipped with serial RS485 ports for communications between panels and shall have a USB port for programming.

F. Switching Devices:

1. Device Node Capacity: The lighting controller network shall support switch input control of up to 32 data line device nodes. The first 8 device nodes shall be powered by the lighting controller. The addition of a power supply or power supply/repeater is required for each additional 20 device nodes up to the maximum of 32. Each device shall have a unique address and shall be capable of being programmed to the applicable functions described in the Switched Input Types heading in this specification. Momentary push buttons are required to implement the momentary switch types and maintained switches are required to execute the maintained switch types.
2. Data Line Media: The data line shall consist of RS485 communications protocol transmitted over CAT-5 or CAT-6 cable. The controller and the data line devices shall each be equipped with two RJ45 female connectors to facilitate cable connection. Both daisy chain and “T” (3 direction branching) of cable

runs shall be permitted. "T" branching shall be accomplished by the addition of power supply/repeaters. It shall be able to be wired in a "home run" configuration for other devices by the addition of a Hub.

3. Switch Stations: Data line switch stations shall be available in momentary push button (1-6 switches and pilots) and maintained (1-4 switches and pilots). Also momentary and maintained key switches shall be available (1 switch per station). Each key switch shall have a pilot light. The switch pilot lights shall be programmable to track the status of relays (default pilot1 to relay1), relay groups and presets. The pilot lights may also be programmed to be always OFF or always ON. The 1-6 pushbutton stations shall be designed for single gang mounting.
4. Photocell Controllers: The photo controller shall be provided with 256 light to dark levels (0- 1800fc). It shall allow selection of 8 individual set points for OFF and ON and includes a selectable range of dead-band. It shall have a settable filter. It shall be programmable to any relay(s) on the network.
5. Dry Contact Switch Module: The module shall provide 4 inputs that accepts momentary, momentary PB and maintained switch closures. Each input shall control any or all of the relays in the lighting controllers on the network. It shall provide four pilot outputs that provide true status of relays, groups and presets.
6. Disable Key Switch: The disable switch shall provide a RJ45 connector that shall disable all devices down line with the closure of a key switch. It shall also provide two RJ45 connectors to pass data through. It shall indicate with an LED when the disable switch is active.

G. Programming: Programmable controllers shall be capable of being programmed, monitored or controlled through any or all of the below methods. All programming changes shall take effect immediately as they are programmed and shall not suspend or disable switches or other system functions. The same functions shall be available for any of the connection types.

1. Local Key Pad and Display: The system user shall be able to program, monitor and control any of the controller features and functions through the use of simple menu-driven self-prompting user interface consisting of a 4-line 20-character backlit LCD display and 6 selection keys that change function based on the current operating mode.
2. Serial Direct Connect: The system user shall be able to program, monitor or control any of the controller features and functions utilizing the manufacturer's software (Basis of Design: Apprentice II Pro Windows-based graphical user interface software with use of a USB port).

H. Diagnostic Aids: Each programmable lighting controller shall be provided with an LED that shall indicate that the main power supply is present and operational. Each relay output shall have an LED pilot to indicate the current status of all controlled relay outputs. In addition, the system user shall be able to monitor and control any programmable lighting controller directly and in real time through any of the programming methods listed above. System users shall be able to view the current

status of any or all relay outputs, force any relay output ON or OFF, and view the current status of any or all switch inputs.

I. Data Protection and Storage: All programmed data shall be stored in nonvolatile RAM that shall protect all stored programming data from loss during a power outage for a minimum period of 50 years without power of any type.

J. Power Failure and Power-Up Options: Each programmable lighting controller shall be provided with circuitry that shall automatically shut down the controller whenever the incoming power fails to be delivered to the controller within required limits. When power is returned to the controller, one of the following power-up modes will be implemented (user selectable) for each controlled relay output in the system.

1. On if Input 1: Upon restoration of incoming control power, the controller electronics shall be restarted and the selected relays will be forced ON if input 1 is active.

2. Forced ON: Controller will force the selected relay output to the ON state after power-up. Time-scheduled events that were to take place during the power outage will be ignored; however, all future scheduled events will be activated.
3. Forced OFF: Controller will force the selected relay output to the OFF state after power-up. Time-scheduled events that were to take place during the power outage will be ignored; however, all future scheduled events will be activated.

K. Manual Push Buttons: The controller shall be supplied with an ALL ON and ALL OFF manual push-buttons to manually turn all relay outputs to the ON or OFF state.

L. Input Flexibility: Each switch input shall accept the logical equivalent of a dry contact 2 or 3 wire maintained or momentary switch.

M. Input to Output Programmability: Any switch input may be programmed to control any or all of the controllers relay outputs without limitations in the network.

N. Relay Groups: The controller also shall support the grouping of individual relay outputs into 48 relay groups and be controlled network wide. These groups may be controlled by switch or time based signals.

O. Switch Input Types: Each of the programmable lighting controller switch inputs shall be programmable for one of the below listed switch types.

1. Momentary ON/OFF: When momentary contact is made between the ON and COM, relay outputs controlled by this input are turned ON. When momentary contact is made between OFF and COM, relay outputs controlled by this input are turned OFF.

2. Momentary Push-Button: When momentary contact is made between the ON and COM, relay outputs controlled by this input are turned ON and OFF alternately, based on current state, each time contact is made.
3. Maintained ON/OFF: When contact is made between the ON and COM, relay outputs controlled by this input are turned ON. When contact is broken between ON and COM, relay outputs controlled by this input are turned OFF.
4. Maintained Multi-Way: When contact is either made or broken between the ON and COM, relay outputs controlled by this input will be toggled between ON and OFF conditions. This function shall be similar to that of standard 3 and 4 way switches.
5. Set Preset: When momentary contact is made between the ON and COM, the selected preset scene will be activated. Controller shall provide 48 user definable presets that can be activated by switch input or timer.
6. HID Bi-Level: This feature requires the configuration of ON/OFF relay outputs and HI/LOW relay outputs. The first momentary contact between ON and COM sets the ON relay outputs to ON and the HI/LOW outputs to HI (for at least 15 Minutes). The second contact switches the HI/LOW outputs to LOW; the third contact sets the HI/LOW output to HI; the fourth to LOW, and the fifth to HI. The cycle then repeats until momentary contact is made between switch input OFF and COM. Then the ON/OFF outputs and HI/LOW outputs are turned OFF.
7. Two-Step Alternating Sequence: The first time the switch is activated, relay outputs programmed as “Group A” are turned ON and relay outputs programmed as “Group B” are turned OFF. The second time the switch is activated, “Group A” relay outputs are turned OFF and “Group B” relay outputs are turned ON. The third time the switch is activated, the pattern begins again at step one.
8. Four-Step Alternating Sequence: The first time the switch is activated, relay outputs programmed as “Group A” are turned ON and relay outputs programmed as “Group B” are turned OFF. The second time the switch is activated, “Group A” relay outputs are turned OFF and “Group B” relay outputs are turned ON. The third time the switch is activated; both “Group A” and “Group B” relay outputs are turned ON. The fourth time the switch is activated; both “Group A” and “Group B” relays are turned OFF. The fifth time the switch is activated, the process begins again at step one.
9. Timed ON: The timed ON input shall operate either from the input closure or open. If programmed to operate from the closure, the relays turn ON when the input closes and turn OFF after the timed duration. The relays do nothing when the input opens. If programmed to operate from the open, the relays turn ON when the input closes and remain ON. When the input opens, the relays turn OFF after the timed ON duration.
10. Input Disable: When maintained contact is made between the ON and COM, inputs programmed for disable from this switch input will be ignored.
11. Timer Disable: When maintained contact is made between the ON and COM, timers programmed for disable from this switch input will be ignored.
12. Network Disable: When maintained contact is made between the ON and COM, network commands sent to the controller via the control network are ignored.

13. Output Override: When maintained contact is made between the ON and COM, relay outputs controlled by this input are either turned ON, OFF or HELD in their current state until the input is released. All inputs, timers and network commands are ignored for controlled relay outputs.
14. Force Timer: When momentary contact is made between ON and COM, the selected timer shall be activated.

P. Photo / Motion Sensor Inputs: Programmable lighting controllers shall be designed to accept dry contact control inputs from photo or motion sensors and program them to perform any of the available switch input functions.

Q. Fire Alarm System Inputs: Programmable lighting controllers shall be designed to accept dry contact control inputs from fire alarm control systems and program them to perform any of the available switch input functions.

R. Switch Enable/Disable: The system shall support the ability to enable/disable switch inputs according to a user-defined set of times.

S. Blink Alert: Each relay output within the programmable lighting controller can be individually programmable to blink prior to being turned OFF. The blink alert function shall blink each relay twice prior to turning OFF with a timer OFF sweep to warn occupants of the upcoming OFF event. If an ON command is received during the blink alert time, relay output will be overridden and left ON for the override time. Override times shall be adjustable from 5 to 999 minutes in 1-minute increments.

T. Astronomical Clock: Each controller shall contain an astronomical time clock that shall calculate sunrise and sunset times based on the geographical positioning information provided during the programming of the system. Sunrise and sunset times may be used as activation times for any system timer. In addition to sunrise and sunset time activation, the control shall be capable of programming activation time for the system timer for before and after these times based on an offset of 1-999 minutes either before or after the calculated sunrise or sunset event. It must be capable of adjusting the start and end of DST.

U. Open/Closed Time Control: The user shall also have the option of controlling relay outputs in relation to the open/closed times of the facility. The open/closed times may vary for different days of the week and may be programmed for each day of the year.

V. Time-of-Day Scheduling: Each programmable lighting controller shall be provided with a minimum of 48 available timers (scheduled events) for use in developing time-of-day automated schedules. Each timer shall have the ability to turn any or all relay outputs ON, OFF at any standard time in 1-minute increments or at times calculated by the astronomical clock for sunrise and sunset with offset. Timers shall be day-of-week selectable timers and may be programmed to activate on any combination of days of the week (Sunday through Saturday), on all days, or to activate on a specific date only ("Holiday Schedule"). Each non-holiday timer shall be capable of being

programmed to either halt operation on holidays or to ignore holidays and continue normal operations on holidays.

W. OFF Sweeps: The system shall also support after hours OFF sweeps of selected relay outputs at user defined one, two, or three hour intervals.

X. Pre-Sets: The lighting controller shall support up to 48 user-defined presets (ON/OFF relay patterns). The presets may be invoked by switch or timer actuation.

Y. Descriptive Names: The system shall support the optional assignment of descriptive names (up to 10 characters) to the lighting controller, relay outputs, relay groups, inputs, timers, and presets.

Z. Password Protection: Each Programmable controller shall have a user definable 6-number password, which will lock out the keypad programming functions.

AA. Networking:

1. Network Capacities: In addition to the data line devices mentioned in Section F, controllers shall be linked together on the data line to form a Local Area Network (LAN) of up to 48 relays.
2. Network Features: The controller (Node 1) shall be the LAN Master and process all communications, command and data with the other controllers. The LAN supports global switching, time based control, and data sharing.
3. Network Configurations: The network shall consist of up to 12 lighting controller nodes (4 relay) with a total of no more than 48 relay outputs and inputs. Programming of the LAN shall be done from the master controller screen/keypad or with software.
4. Optional Programming Mechanisms: Programming may be done from a properly equipped personal computer loaded with manufacturer’s software.

2.12 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18AWG. Comply with requirements in Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

2.13 FINISHES

A. Devices and Wall Plates: Shall match other wiring devices in project. Refer to Specification Section 16140 (Wiring Devices).

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space.

C. All occupancy/vacancy sensors shall be wired ahead of room light switching.

D. All sensor locations are approximate refer to manufacturer’s installation instructions prior to installation.

E. Ultrasonic ceiling mount sensors should be located a minimum of six (6) feet from HVAC air vents.

F. Initial time-delay setting shall be 20 minutes.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient Temperature: 0° to 40° C (32° to 104°F).
2. Relative humidity: Maximum 90 percent, non-condensing.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 16 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 1.

END OF SECTION

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SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

B. SPD: Surge Protective Device.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power wiring.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge protective devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.
    c. Kitchen, Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

5. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.

6. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Top or bottom

C. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Amp rating indicated on Panel Schedule is minimum required rating.

2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.
4. General Electric

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Circuit breaker or lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.
4. General Electric

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.
4. General Electric

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."

D. Mount top of trim 90 inches above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices not already factory installed.

G. Install filler plates in unused spaces.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 25 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-Resistant GFCI receptacles.
3. Twist-locking receptacles.
4. Wall-box motion sensors.
5. Snap switches and wall-box dimmers.
6. Communications outlets.
7. Fire-classified floor boxes for on-grade and above-grade concrete floors, poke-through assemblies, and multioutlet assemblies.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.
2. Division 26 Section “Common Work Results for Electrical”

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. UTP: Unshielded twisted pair.

1.4 REFERENCES

A. UL 5 - Surface Metal Raceways and Fittings.

B. UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

C. NFPA 70 - National Electrical Code.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets and descriptive literature on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings:
   1. List of legends and description of materials and process used for premarking wall plates.
   2. Indicate raceway layouts, each system component required for complete system, raceway lengths, device types, locations; identify all circuits.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

E. Manufacturer's instructions: Printed installation instructions for each system component; include storage requirements.

F. Project Record Documents: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms regularly engaged in manufacture of raceway and box distribution products and systems of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. Source Limitations:
   1. Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
   2. Obtain each type of round recessed raised and stage floor box through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Comply with requirements of applicable local codes, NEC, UL, and NEMA Standards.

D. Comply with NFPA 70.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, appearance and performance are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

F. Electrical Floor Boxes and Components: Comply with requirements of applicable local codes, NEC, UL, and NEMA Standards pertaining to floor boxes and components. Meet or exceed UL Fire Classification requirements for recessed and flush style boxes. Listed and labeled in accordance with NFPA 70, Article 100.

G. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

H. Accessibility Compliance: Design device flange to meet ADA Accessibility Guidelines as to changes in floor and ground surface levels. Flanges shall be beveled so the slope is no greater than 1:2.

1.7 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

   1. Cord and Plug Sets: Match equipment requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

D. Protect from damage due to weather, excessive temperature, and construction operations.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all wiring devices as indicated on drawings and/or as required for project.

2.2 MANUFACTURERS

A. Coordinate with Architectural specifications and drawings for device style, color and finish for all wiring devices prior to commencing work or ordering material. Style, color and/or finish may vary from area to area and room to room.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).
3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
4. Legrand/Wiremold; Floor Box Devices (Wiremold)
5. Cooper

2.3 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. (Leviton and Pass & Seymour are acceptable manufacturers).

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CR5362 (duplex).
b. Leviton; 5362 (duplex).
c. Pass & Seymour; 5362 (duplex).
d. Or Approved Equal by Cooper

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. Provide tamper-resistant convenience outlets in all Kindergarten, Pre-Kindergarten, 1st Grade, and 2nd Grade Classrooms.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL8300SG.
b. Leviton; 8300-SGG.
c. Pass & Seymour; 63H.
d. Or Approved Equal by Cooper

2. Description: Labeled to comply with NFPA 70.

2.4 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell GF 8300.
b. Pass & Seymour; 2094.
c. Leviton 7599-FW
d. Or Approved Equal by Cooper

C. Duplex “Weather-Resistant” GFCI Convenience Receptacles, 125 V, 20A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Arlington Industries Low Profile INBOX Series, as construction requires; DBVR1C
b. Or Approved Equal by Leviton
c. Or Approved Equal by Hubbell
d. Or Approved Equal by Cooper
e. Or Approved Equal by Pass & Seymour

2. Provide with Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R, weather-resistant, IP 64 rated, die-cast aluminum with lockable cover.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Single Convenience Receptacles, 125 V, 30 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-30R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L530R.
b. Or Approved Equal by Hubbell
c. Or Approved Equal by Leviton
d. Or Approved Equal by Pass & Seymour

2.6 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CS1221 (single pole), CS1223 (three way).
b. Leviton; 1221-2 (single pole), 1223-2 (three way).
c. Pass & Seymour; 20AC1 (single pole), 20AC3 (three way).
d. Or Approved Equal by Cooper

C. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1557.
b. Leviton; 1257.
c. Pass & Seymour; 1251.
d. Or Approved Equal by Cooper

2.7 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.8 COMMUNICATIONS OUTLETS

A. Telephone/Data Outlet:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 3560-6.
   b. Leviton; 40649.

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6. Comply with UL 1863.

2.9 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Stainless steel.
2. Material for Finished Spaces: 0.040-inch thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.10 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

F. Floor Outlets: Floor outlets for power and/or telephone shall be U.L. listed and have a 1 to 4 hour fire rating for use in floors from 2-1/2” to 8” thick. The complete assembly shall consist of a floor service fitting at top, with receptacle pre-wired and ending in 6” leads for box at bottom; a fire-rated center coupling with separate raceways for power and communication, factory equipped with inorganic chemical panels that will expand on exposure to high heat to form a flame, smoke and air-seal within the entire assembly; a barriered extension channel and a barriered junction box at bottom with screws for leveling box in place. Provide one abandonment plate

for each floor outlet installed to insure original fire rating of floor when service fitting is removed. RC-700-A by Raceway Components, Inc., or approved equal.

1. Service fittings shall be flush type with aluminum floor plates and closure plugs for both duplex receptacles and telephone outlets.
2. Provide carpet flanges where carpet is indicated on Architectural Drawings.
3. Floor boxes shall be of the concrete adjustable type, approved equal to raceway components #RC-768-15 AMPS complete with flush service fitting for duplex receptacle and for telephone or intercommunication outlets. Edges of boxes shall be installed flush with the finished floor. Carpet flanges shall be provided for locations where carpet is indicated on Architectural Drawings.

2.11 FIRE CLASSIFIED FLOOR BOXES FOR ON-GRADE AND ABOVE-GRADE CONCRETE FLOORS

A. Classification and Use: Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to comply with UL514A and/or UL514C and Canadian Standard C22.2, No. 18-98 and bear the U.S. and Canadian UL Listing Mark. Fire classified floor boxes shall also have been tested by UL and classified for fire resistance and bear the U.S. and Canadian UL Classification Mark. The floor boxes shall conform to the standards set forth in the National Electrical Code, Section 300-21.
   1. Fire Rated Floor boxes shall be classified for use in 1, 1-1/2, or 2-hour rated floors and 1, 1-1/2, or 2 hour rated floors employing unprotected steel floor units and, or concrete floors with suspended ceilings. Fire resistive designs with suspended ceilings shall have provisions for accessibility in the ceiling below the floor boxes.
   2. Floor boxes shall have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
   3. These devices are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids such as commercial kitchens.
   4. Floor boxes shall be suitable for use in air handling spaces in accordance with Section 300-22C of the National Electrical Code.

B. Configurations:
   1. Fire classified floor boxes provide an interface between power, communication and audio/visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power, communication and/or A/V device outlets are required. These devices provide flush and recessed outlets that will not obstruct the floor area. Refer to the Drawings for types.
   2. Fire classified floor boxes shall be compatible with the complete line of Ortronics workstation connectivity outlets and modular inserts (or approved equal), or Pass & Seymour Network Wiring System (or approved equal).

C. Omnibox 880 Series Fire Classified Floor Boxes: Boxes shall be available in one-, two-, or three-gang configurations and available in a stamped-steel version. Boxes shall also be rectangular in shape and available in deep and shallow versions. All boxes shall also provide pre- and post-pour adjustment. All boxes shall also provide a removable barrier between the individual compartments for greater capacity when required.
   1. Model: 880M3FC Fire Classified Floor Boxes as manufactured by Legrand/Wiremold (or approved equal).
   2. Body: Boxes shall be manufactured from stamped steel and formed. Boxes shall be available in one-, two-, or three-gang configurations. Shallow stamped steel versions shall provide 3/4-inch of pre-pour adjustment and 1/2-inch of post-pour adjustment. Deep stamped steel versions shall provide 1/2-inch of pre-pour adjustment and 1/2-inch of post-pour adjustment. Minimum concrete depth of deep boxes shall be 4-1/2 inches. Minimum concrete depth of shallow boxes shall be 3-1/4 inches. Overall box dimensions for both shallow and deep boxes shall be as follows:
      a. Three-gang: 4-13/16 inches W by 12 inches L.
   3. Three-gang Boxes: Deep boxes shall provide at least a total of 180 cu in (2951ml) of device wiring chamber volume. This total volume shall be divided among the three gangs with 54 cu in (885ml) of volume in each of the outside gangs and 67.5 cu in (1106ml) of volume in the center gang. Three-gang shallow boxes shall provide at least a total of 117 cu in (1917ml) of device wiring chamber volume. This total volume shall be divided among the three gangs with 36 cu in (590ml) of volume in each of the outside gangs and 45 cu in (737ml) of volume in the center gang.
      a. The shallow and deep versions shall include three (3) intumescent stems with a 1-1/4-inches diameter pass-through channel that allows the pathway to close off during a fire. The box shall provide an insulated assembly that will go on the underside of the floor structure to slow down the transfer of heat to the floor box.
   4. Flanges: Brushed aluminum flanges shall be approved for use on carpet, tile, or wood covered floor applications. Brushed aluminum flanges and cover plates shall have a buffed appearance and be protected with a lacquer finish. Brushed aluminum cover plate dimensions shall be 3.29 inches W by 4.310 inches L. Brushed aluminum cover plates shall seat inside only brushed aluminum and be flush with the finish floor. All cover plate options shall provide for both power and communication services.
      a. Flange Dimensions: Brushed aluminum flange dimensions shall be as follows:
         1) Three-Gang:
            a) Brushed aluminum, 13.170 inches wide, 5.940 inches length.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Surge Protective Devices (SPD): Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Install wiring devices where shown, in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to ensure that products serve intended function. Delay installation of devices until wall construction and wiring is completed.
11. Install receptacles and switches only in electrical boxes which are clean, free from excess building materials, debris, and similar matter.
12. Install all wiring devices plumb and aligned in the plane of the wall, floor, or ceiling in which they are installed.
13. Contractor shall coordinate wiring between the dimmer switches and dimming ballasts specified and/or furnished by the Contractor.

E. INSTALLATION – GENERAL

1. Install in accordance with manufacturer's instructions for system components.
2. Install in accordance with complete system instruction sheets.
3. Install enclosures to be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.
4. Install enclosures to be electrically continuous and bonded in accordance with the National Electric Code for proper grounding.

F. FLOOR BOX INSTALLATION

1. Strictly comply with manufacturer's installation instructions and recommendations and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.
   a. Mechanical Security: Raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.
   b. Electrical Security: Metal raceway shall be electrically continuous and bonded in accordance with the National Electric Code for proper grounding.
   c. Accessories: Provide accessories as required for a complete installation, including insulated bushings and inserts where required by manufacturer.
   d. Unused Openings: Close unused raceway openings using manufacturer's recommended accessories.
2. Install floor boxes to permit all wiring to be completed at floor level.

G. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

H. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

I. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

J. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

K. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

L. Coordinate locations of boxes in fire rated partitions and slabs so as to not affect the fire rating of the partition or slab. Notify the Architect in writing where modifications or additional construction are required to maintain the partition or slab fire rating.

M. Conduits to Surface Mounted Raceways (SMR) shall be sized to equal the capacity of the SMR channel or cabling capacity. The raceway size of the SMR must be designed to meet the size and number of cables to be installed and include space for the installation of communication outlets. Individual workstation conduits are to be dedicated to only one outlet box each, and shall not be “daisy-chained” together.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Examination:

1. Do not begin installation until substrates have been properly prepared.
2. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B. Preparation:

1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Prior to energization, check for continuity of circuits, for short circuits, and check grounding connections. After energization, check wiring devices to demonstrate proper operation and check receptacles for correct polarization.

F. Protection:

1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 26 2813

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches & enclosed controllers.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type fuseholders.
3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
4. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient temperature adjustment information.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Coordination charts and tables and related data.
5. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class RK1, time delay.
2. Feeders: Class RK1, fast acting, Class RK1, time delay.
3. Motor Branch Circuits: Class RK1 time delay.
4. Other Branch Circuits: Class RK1, time delay.
5. Control Circuits: Class CC, time delay.

B. Plug Fuses:

1. Motor Branch Circuits: Edison-base type, single-element time delay.
2. Other Branch Circuits: Edison-base type, single-element time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Qualification Data: For qualified testing agency.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.
4. General Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.
4. General Electric.

B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Hookstick Handle: Allows use of a hookstick to operate the handle.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 SHUNT TRIP SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Cooper Bussmann, Inc.
2. Ferraz Shawmut, Inc.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.
4. General Electric

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

E. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Wash-Down Areas: NEMA 250, Type 4X stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

2.6 SAFETY AND DISCONNECT SWITCHES

A. Safety switches shall be of the quick-make, quick-break visible blade-knife switch type. They shall be of the heavy-duty type, fused or nonfused type, as indicated on the Drawings. Fused switches shall have positive pressure fuse clips. Switches shall be fully interlocked, with provision to neutralize the interlock by a screwdriver while under load without interrupting the circuit. Switches shall be complete with insulated base, and pressure or solderless slugs. Handles shall be front operated. All switches shall be horsepower rated, capable of breaking stalled-rotor motor current at these ratings. Switches shall have provision for padlocking in the "on" or "off" positions. Provide fusible safety switches where indicated. Fuse clips shall be positive pressure rejector-type fuse clips suitable for use with UL Class R fuses.

B. Provide safety switches with number of switched poles as indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch.

C. All safety switches installed in indoor locations shall be NEMA 1 general-purpose enclosures unless otherwise shown.

D. Safety switches installed in exterior locations shall be NEMA 3R (water resistant) unless otherwise shown.

E. Safety switches installed at cooling towers, in kitchens, and in other wet areas, shall be NEMA 4 (stainless steel), unless otherwise shown.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

F. Installation of Safety and Disconnect Switches:

1. Install safety and disconnect switches where shown, in accordance with the manufacturer's written instructions, the applicable requirements of the NEC, the NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended function.
2. Provide safety switches where shown and at each motor which is out of sight of, or greater than 50 ft. from, the switch or panel from which the motor circuit is fed
3. Provide all safety and disconnect switches with galvanized angle or other suitable supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas.
4. Install disconnect switches used with motor-driven appliances, motors, and controllers within sight of the controller position unless otherwise indicated.
5. Coordinate safety and disconnect switch installation work with electrical raceway and cable work as necessary for proper interface.
6. Install fuses in fuse holders immediately prior to energization of the circuit in which the fuses are installed. Fuses shall not be installed and shipped with equipment.
7. Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

G. Motors:

1. Motor Installation and Connections:
   a. Motors associated with equipment furnished under other sections of the Specifications will be furnished and installed under the respective section. For such motors, the responsibility under the Electrical Section shall be to provide electrical service and to terminate same adjacent to the associated controller. This termination shall occur in a switch, fused switch, or motor circuit protector as required and/or as shown and noted on Drawings. Electrical service shall also be extended through the associated controller to the motor connector box in flexible conduit.
   b. Furnish and install all power wiring and disconnect switches, starters, etc., required for all equipment specified under the "Controls" section of

the Mechanical Specifications, whether or not specifically indicated on the Drawings. Circuits shall be run to nearest available 120/208 volt power or motor control panel.

c. Each motor shall be connected to a separate branch circuit except where shown otherwise. Unless otherwise indicated, circuits shall run to the motor via starting equipment and conduit to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible conduit as hereinbefore specified. Ground bond or separate copper conductor shall be made from motor frame to rigid conduit system.

d. Should any equipment and/or motors be furnished requiring electrical service different from that indicated for the equipment and/or motor(s) specified, or electrical connections at more than one point, or at a point different from the one indicated on the Drawings, it will be the responsibility of the Contractor to make the required coordination and changes at no additional cost to the Owner. Refer to Division 23.

2. Motor Control Wiring: Complete motor control wiring shall be provided under the Mechanical Section of these Specifications.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 26 2913

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.
3. Multispeed.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

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.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS AND PUSHBUTTONS

A. For each building utility motor to which the Contractor makes connection and which is not otherwise noted, provide a disconnect switch and magnetic motor starter, separate or in combination as indicated or required. Overload devices must be suitable for protection by a minimum of 15 amp. circuit breaker or fuse. The overload devices in the starters shall be sized to agree with the current rating shown on the motor nameplate.

B. Individual Motor Starters:

1. Individual motor starters shall consist of an integrally mounted, magnetic, full-voltage, non-reversing (FVNR), starter in a heavy-duty type, dead front, sheet steel enclosure, and surface-mounted. Size and number of poles shall be as shown and required by equipment served. All starters shall be constructed and tested in accordance with the latest NEMA standards.
2. Magnetic starter contacts shall be solid silver cadmium oxide alloy, and shall not require any filing, dressing, or cleaning throughout the life of the starter.
3. Operating coils shall be 120 volts, and shall be pressure molded and designed so that accidental exposure to excessive voltage up to 480 volts will not damage the coil. The starter design shall also be such that when a coil fails due to an over-voltage condition, the starter shall definitely open, and shall not freeze in the closed position.
4. All starters shall have manual reset, tripfree overload relays in each phase conductor. Three-phase FVNR starters shall have three overload relays. Single-phase FVNR starters shall have an overload relay in each ungrounded

conductor. Overload relays shall not be field-convertible from manual to automatic reset.

5. Provide RUNNING pilot lights for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter, and shall not be wired across the operating coil.
6. Provide starters with HAND-OFF-AUTOMATIC switches (for motors with automatic control), or START-STOP Pushbuttons (for motors with manual controls) as shown or required. Provide for FAST-SLOW speed selection from HVAC control system for all 2-speed starters. All 2-speed starters shall have deceleration relays between FAST and SLOW speeds. Coordinate motor starter controls with the requirements of this Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
7. A single-phase control power transformer shall be included integrally with each starter for 120 or 24 volt control power. The primary shall be connected to the line side of the motor starter; the secondary shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock" and control wiring. In addition, it shall be possible to field-install one or more additional auxiliary contacts without removing existing wiring, or removing the starter from its enclosure.
9. Provide a 3-phase power monitor for each motor starter serving a motor of 20HP or greater. Monitor relay shall drop out upon loss of any phase, undervoltage on any or all phases, or phase reversal from A-B-C sequence. Relay shall be adjustable for trip range and shall automatically reset upon correction of trouble.
10. All motor starter enclosures shall be NEMA 1, general purpose enclosures, unless shown otherwise.

C. Combination Motor Starters:

1. Combination motor starters shall consist of an integrally mounted magnetic starter and a fusible disconnect switch in a heavy-duty type, dead front, sheet steel NEMA 1 (indoor) or NEMA 3R (outdoor), surface-mounted, general purpose enclosures. Size and number of poles shall be as required by equipment served. Combination motor starters shall be as specified for individual motor starters except as modified herein.

D. Disconnect Switch: Disconnect switch shall be as specified in "Safety and Disconnect Switches".

E. Unit Wiring: Unit shall be completely prewired to terminals to eliminate any interior field wiring except for connection of power supply conductors to switch line side terminals, motor leads to the starter load side terminals and control conductors to holding coil terminals.

F. Manual Motor Starters: Manual motor starters shall consist of an integral starter and a manual reset bimetallic trip type thermal overload elements protection in a common enclosure, surface-mounted. Size and number of poles shall be as shown and required by equipment served. Furnish pilot light as needed.

G. Manual motor starter with overload protection, 1 hp maximum, 115 or 230 volts, Square D #FG1-(l) Pole, FG2-(2) Pole; Square D #FG1P-(l) Pole, with pilot light, FG2P-(2) Pole, with pilot light.

H. All manual motor starter enclosures shall be NEMA 1 (for indoor) and NEMA 3R (for outdoor), general purpose enclosures, unless shown otherwise.

I. Manual motor starters to be flush in rooms with finished floors and walls. Provide a stainless steel cover.

2.2 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Surface mounting.
4. Pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button bimetallic type.
4. Surface mounting.
5. Pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button bimetallic type.
4. Surface mounting.
5. Pilot light.

E. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type.

   a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

6. Melting Alloy Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

7. Bimetallic Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

8. Solid-State Overload Relay:

    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

9. External overload reset push button.

F. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. Siemens Energy & Automation, Inc.
    c. Square D; a brand of Schneider Electric.
    d. General Electric

2. Fusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J fuses.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

3. Nonfusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.

b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

4. MCP Disconnecting Means:

a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

5. MCCB Disconnecting Means:

a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
e. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.

2.3 MULTISPEED MAGNETIC CONTROLLERS

A. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Siemens Energy & Automation, Inc.
e. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing.

3. Contactor Coils: Pressure-encapsulated type.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24 -V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
6. Compelling relays shall ensure that motor will start only at low speed.
7. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
8. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
9. Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.
10. Melting Alloy Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

11. Bimetallic Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

2.4 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Kitchen, Wash-Down Areas: Type 4X.
4. Other Wet or Damp Indoor Locations: Type 4.

2.5 ACCESSORIES

A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.

B. Control Relays: Auxiliary and adjustable time-delay relays.

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Install fuses in each fusible-switch enclosed controller.

C. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

D. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

E. Comply with NECA 1.

F. Installation of Motor Starters.

a. Install motor starters where shown, in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended function.
b. Install overload heaters in each motor starter. Heater ratings shall be based on actual motor nameplate full load amps.
c. Motor starters shall be provided to properly coordinate with motors as furnished by Division 23. Motor starter controls shall be provided to properly coordinate with controls specified in Division 23.
d. Provide all individual and combination motor starters with galvanized angle or other suitable supports where mounting on wall or other rigid surface is impractical. Starters shall not be supported by conduit alone. Where motor starters are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas. Manual motor starters shall be installed plumb and aligned in the plane of the wall in which they are installed.

G. Motors:

1. Motor Installation and Connections:
   a. Motors associated with equipment furnished under other sections of the Specifications will be furnished and installed under the respective section. For such motors, the responsibility under the Electrical Section shall be to provide electrical service and to terminate same adjacent to the associated controller. This termination shall occur in a switch, fused switch, or motor circuit protector as required and/or as shown and noted on Drawings. Electrical service shall also be extended through the associated controller to the motor connector box in flexible conduit.
   b. Furnish and install all power wiring and disconnect switches, starters, etc., required for all equipment specified under the "Controls" section of the Mechanical Specifications, whether or not specifically indicated on the Drawings. Circuits shall be run to nearest available 120/208 volt power or motor control panel.
   c. Each motor shall be connected to a separate branch circuit except where shown otherwise. Unless otherwise indicated, circuits shall run to the motor via starting equipment and conduit to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible conduit as hereinbefore specified. Ground bond or separate copper conductor shall be made from motor frame to rigid conduit system.
   d. Should any equipment and/or motors be furnished requiring electrical service different from that indicated for the equipment and/or motor(s) specified, or electrical connections at more than one point, or at a point different from the one indicated on the Drawings, it will be the responsibility of the Contractor to make the required coordination and changes at no additional cost to the Owner. Refer to Division 23.

2. Motor Control Wiring: Complete motor control wiring shall be provided under the Mechanical Section of these Specifications.

3.2 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

A. Bundle, train, and support wiring in enclosures.

B. Connect selector switches and other automatic-control selection devices where applicable.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
1. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.

C. Motor Starters:

1. Pre-Energization Check: Check motor starters for continuity of circuits and for short circuits.

2. Post Hook-Up Test: Subsequent to wire and cable hook-ups, energize motor starter and demonstrate satisfactory functioning.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION

SECTION 26 3600

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Remote annunciation systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, power sources, and load.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Qualification Data: For manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches and remote annunciators through one source from a single manufacturer.

C. 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.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:

   a. Caterpillar; Engine Div.
   b. Emerson; ASCO Power Technologies, LP.
   c. Generac Power Systems, Inc.
   d. Kohler Power Systems; Generator Division.
   e. Onan/Cummins Power Generation; Industrial Business Group.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Unless indicated otherwise, transfer switches shall be 3-pole type.

H. Neutral Switching. Where four-pole switches are indicated, provide overlapping neutral contacts.

I. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

J. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

K. Battery Charger: For generator starting batteries.

1. Float type rated 10 A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or

annunciator and control panels shall have communication capability matched with remote device.

M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations.

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

N. Enclosures: General-purpose NEMA 250, Type 1 (or Type 3R as indicated) complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Automatic Transfer Switch Features

1. Each automatic transfer switch shall be the mechanically held, electrically operated type rated for continuous duty in an unventilated sheetmetal enclosure. The switch shall be double throw having electrically operated normal-emergency positions inherently interlocked mechanically and with main contacts mechanically attached to a common shaft. A manual operator shall be provided, with same contact-to-contact transfer speed as the electrical operator to prevent a flashover. All main contacts shall be silver alloy wiping action type, shall move simultaneously during transfer, shall be protected at arcing contacts and shall transfer in 1/10th of a second or less. Switch shall

have single operator to transfer main contacts. All switch and relay contacts, coils, springs and control elements shall be removable from the front of the transfer switch without removal of the switch panels from the enclosure and without disconnection of drive linkages or power conductors. Sensing and control relays shall be continuous duty industrial control type with minimum contact rating of 10 amperes.

2. The automatic transfer switch shall sense complete loss of normal power on any phase and transfer the load to emergency power. When the normal power is restored, the automatic load transfer control shall sense this and retransfer the load from the emergency power to normal power. The operating current for transfer shall be obtained from the source to which the load is to be transferred. The transfer switch shall be capable of being transferred (switched) manually in either direction.
3. The complete automatic load transfer control shall be enclosed in a NEMA 1 enclosure for installation indoors. The enclosure shall have door handle with key operated lock. The transfer switch shall be electrically and mechanically interlocked to positively prevent the load from being energized simultaneously by normal and standby power.
4. Transfer switches shall have a minimum withstand and closing rating (amperes) as listed below; these ratings shall be obtained without contact welding. These RMS symmetrical fault current ratings shall be listed in the UL listing or component recognition procedures for the transfer switches supplied. All withstand tests shall be external to the transfer switch. Tests conducted with overcurrent protective devices internal to the switch, in such a manner that the transfer switch interrupts the current rather than withstanding the current, are not acceptable under this definition of withstand.

Transfer Switch Continuous Current Ratings	Withstand and Closing Ratings
40A, 70A, 125A	14,000A RMS
150A, 260A	30,000A RMS
400A	42,000A RMS
600A, 800A, 1000A	65,000A RMS

5. Transfer switches shall be UL listed per Standard 1008, and shall be suitable for use on emergency and legally required standby systems in accordance with ANSI-C1 rated for total system load including all type loads described in Section 1 of UL Standard 1008.
6. Control accessories shall be mounted in separate smaller cabinet mounted on inside of main cabinet door, to allow for ease of service access when main cabinet lockable door is opened, but to prevent access by unauthorized persons. Control disconnect plugs shall be provided to de-energize control circuits to avoid shock hazard while making control adjustments. The solid-stage voltage sensors and time delay modules shall be plug-in circuit boards with gold contacts for ease of service. The control relays shall also be plug-in type.
7. Solid state undervoltage sensors shall simultaneously monitor all phases of the normal source and all phase (all 3 phases for 3 phase systems) of the emergency source to provide adjustable range sensors for field adjustment for

specific application needs. Pick-up settings shall be adjustable from minimum of 85% to maximum of 98% of nominal voltage. Dropout settings shall be adjustable from minimum of 74% to maximum of 98% of pick-up setting with fixed dropout time delay of 0.5 seconds. Voltage sensors shall be temperature compensated type, for maximum deviation over the temperature range of minus 25 degrees F (minus 32 degrees C) to plus 175 degrees F (plus 79 degrees C). Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of normal or emergency source, even where motor feedback voltages exist.

8. Controls shall signal the emergency power system to start upon signal from normal source voltage sensors. Solid-state time delay start, adjustable from 0 to 6 seconds (factory set at 2 seconds) shall avoid nuisance start-ups on momentary voltage dips or momentary interruptions.
9. Switch shall transfer the load to the emergency power system after the generator set reaches proper voltage and frequency. Solid state time delay transfer, adjustable from 0 to 120 seconds (factory set at 2 seconds) shall allow the engine generator set to stabilize before application of load.
10. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
11. The transfer switch shall control the generator set to allow generator set to start and transfer load within 10 seconds after normal source power failure. It shall be the responsibility of the supplier of the transfer switch that this requirement is met.
12. A Programmed Neutral Position shall be provided to allow voltage generated by motors or other inductive loads, to decay before retransfer or transfer when exercising under load. An adjustable type time delay of 0.5 to 5 seconds shall momentarily stop the transition of the contactor in the neutral position to allow this.
13. Transfer methods that use the phase relationship between the two power sources to control the transfer time are also acceptable.
14. Switch shall retransfer the load to the normal source after normal power restoration. Solid state time delay retransfer, adjustable from 0-30 minutes (factory set at 15 minutes) shall allow normal power to stabilize before retransfer and shall allow staggered retransfer of loads in multiple transfer switch systems.
15. Controls shall signal the engine generator set to stop after load retransfer to normal source. Solid state time delay stop, adjustable from 0-10 minutes (factory set at 8 minutes). If normal source should fail during the delay period, the time delay shall be bypassed and the load instantly retransferred to generator power.
16. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency source to normal source if emergency source fails when normal source is available.
17. Controls shall provide built in "control mode status indicators" consisting of L.E.D.'s to indicate a sequence of functions such as the following:
    a. Source 1 OK

b. 2-Wire Run
c. Source 2 OK
d. Timing for Transfer
e. Transfer Complete
f. Timing for Retransfer
g. Retransfer Complete
h. Timing for Stop

18. These indicators shall allow the operator to determine that the controls are properly sequencing and shall assist in determining sequence of any malfunctions that might occur.
19. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.
20. Provide devices mounted on front of main cabinet door consisting of air-tight, neon position indicator lamps (white-normal and amber-emergency) and a key-operated selector switch to provide the following position and functions:
    a. TEST - Simulated normal power loss to control unit for testing of generator set, including transfer of load. Control system shall provide for "system test without load transfer" for use in that manner when desired.
    b. NORMAL - This is normal operating position and it restores the load to the normal source after test and after time delays.
    c. RETRANSFER - Momentary position to override retransfer time delay and cause immediate return to normal source after test or actual outage.
21. Switch-Position Pilot Lights: Indicate source to which load is connected.
22. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

23. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
24. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
25. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

26. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for the transfer switch monitored.
2. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
3. Lamp Test: Push-to-test or lamp-test switch on front panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator Panel Mounting: Flush in wall, unless otherwise indicated.

B. Identify components according to Division 26 Section "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for the switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

    a. Verify grounding connections and locations and ratings of sensors.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 4113

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection for building site components.

B. The work covered by this section of the specifications consists of furnishing all labor, materials, and items of service required for the completion of a functional and unobtrusive lightning protection system as approved by the architect, engineer, and in strict accordance with this section of the specifications and the applicable contract drawings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. For air terminals and mounting accessories: Layout of the lightning protection system, along with details of the components to be used in the installation.
2. Complete design drawings showing the type, size, and locations of all grounding down conductors, through roof/through wall assemblies, roof conductors, and air terminals shall be submitted to the Architect/Engineer for approval.
3. Include indications for use of raceway, how concealment requirements will be met, and bonding of grounded and isolated metal bodies required by NFPA 780.

C. Qualification Data: For qualified Installer and manufacturer. Include data on listing or certification by UL.

D. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing material.

E. Field quality-control reports.

F. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.

G. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features, including the following:

1. Ground rods.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Certified as a Master Installer/Designer, trained and approved for installation of units required for this Project.

B. System Certificate:

1. UL Master Label.
2. UL Master Label Recertification.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

D. The lightning protection system shall conform to the requirements and standards for lightning protection systems of the UL, NFPA. Upon completion, an application shall be made to the Underwriters Laboratories, Inc. for inspection and certification and shall be delivered to the Owner ensuring that the concealed components have also been monitored during job progress.

E. The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer’s latest approved design. The equipment shall be UL listed and properly UL labeled.

F. If any departure from the contract drawings or submittal drawings covered above are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the architect/engineer for approval.

1.5 COORDINATION

A. Coordinate installation of lightning protection with installation of building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

D. The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation. The contractor shall be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. However, the contractor will be required to coordinate locations of through roofs and submit details of through roof penetrations as required. The contractor shall use a compatible adhesive to adhere lightning protection components to the roof when required. The contractor shall furnish and install the adhesive and obtain an approval of the compatible adhesive from the roof manufacturer prior to the installation. Should the manufacturer require any special walk pads, membrane patches, pavers, etc. under the components of the lightning protection system, it shall be the responsibility of the contractor to furnish and install such items. The lightning protection installer shall be responsible for marking the roof with all conductor and/or pad locations.

E. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other ground systems.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA 780.

B. Roof-Mounted Air Terminals: NFPA 780, Class I copper unless otherwise indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

   a. East Coast Lightning Equipment Inc.
   b. Robbins Lightning, Inc.
   c. Thompson Lightning Protection, Inc.
   d. Bonded Lightning Protection Systems LTD.

2. Air Terminals More than 24 Inches Long: With brace attached to the terminal at not less than half the height of the terminal.
3. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in Division 07 roofing Sections.

C. Main and Bonding Conductors: Copper except for roofs that utilize aluminum.

D. Ground Rods: Copper-clad 5/8 inch in diameter by 96 inches long.

E. Heavy-Duty, Stack-Mounted, Lightning Protection Components: Solid copper.

F. Other Components: Copper except for roofs or related systems that utilize aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.

C. Conceal the following conductors:

1. System conductors.
2. Down conductors.
3. Interior conductors.
4. Conductors within normal view of exterior locations at grade within 200 feet of building.

D. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components.

E. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

F. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.

G. A surge arrestor at the main electrical service entrance is required by Underwriters Laboratories UL96A lightning protection codes and in order to obtain the UL Master Label Certificate of Inspection. It shall be the responsibility of the contractor to verify that a surge arrester is installed on the main electrical service.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

C. All mounting hardware shall be stainless steel to prevent corrosion.

3.3 FIELD QUALITY CONTROL

A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.

B. UL Inspection: Meet requirements to obtain a UL Master Label for system.

END OF SECTION

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SECTION 26 4313

SURGE PROTECTIVE DEVICES FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section describes the materials and installation requirements for surge protective devices (SPDs) for the protection of all AC electrical circuits.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. VPR: Voltage Protective rating.

C. SPD: Surge Protective Device(s), both singular and plural; also, transient voltage surge suppression.

D. I-nominal: Nominal discharge current.

E. MCOV: Maximum continuous operating voltage.

F. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

G. OCPD: Overcurrent protective device.

H. SCCR: Short-circuit current rating.

I. Protection Modes - For a Wye configured system, the device must have directly connected suppression elements between line-line (L-L) line-neutral (L-N), line-ground (L-G), and neutral ground (N-G). For a Delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

1.4 SUBMITTALS

A. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract.

B. Submittals shall include UL 1449 3rd Edition Listing documentation verifiable by visiting www.UL.com, clicking "Certifications" link, searching using UL Category Code: VZCA.
   1. Short Circuit Current Rating (SCCR)
   2. Voltage Protection Ratings (VPRs) for all modes
   3. Maximum Continuous Operating Voltage rating (MCOV)
   4. I-nominal rating (I-n)
   5. SPD shall be Type 1 UL listed and labeled

C. If requested, an unencapsulated but complete SPD shall be submitted to the Engineer for visual review.

D. 3rd party verification testing.

E. Verification of minimum ten (10) year warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm with at least ten (10) years of experience in manufacturing transient voltage surge suppressors.

B. Manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate SPD devices for continuous operation under the following conditions unless otherwise indicated:

   1. Maximum Continuous Operating Voltage(MCOV): Not less than 115 percent of nominal system operating voltage. The MCOV shall be a tested value per UL1449 3rd Edition, section 37.7.3. MCOV values submitted based solely on the MCOV of the surge components used in the SPD will not be accepted.
   2. Operating Temperature: -15 to 140 deg F (-25 to 60 deg C).
   3. Humidity: 0 to 95 percent, noncondensing. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.7 RELATED STANDARDS

A. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,

B. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,

C. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.

D. National Electrical Code: Article 285

E. UL 1283 - Electromagnetic Interference Filters

F. UL 1449, Third Edition, effective September 29, 2009 – Surge Protective Devices

1.8 LISTING REQUIREMENTS

A. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. “Manufactured in accordance with” is not equivalent to UL listing and does not meet the intent of this specification.

B. SPD and performance parameters shall be posted at www.UL.com under Category Code: VZCA. Products or parameters without posting at UL.com shall not be approved.

1.9 COORDINATION, DELIVERY, STORAGE AND HANDLING

A. Coordinate location of field-mounted SPD devices to allow adequate clearances for maintenance.

B. Handle and store equipment in accordance with manufacturer’s Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICE FEATURES

A. Provide an externally mounted surge protective device by Advanced Protection Technologies or approved equal. Approved manufacturers are as follows:
   1. Advanced Protection Technologies
   2. Current Technology
   3. Liebert
   4. Emerson Network Power

B. SPD shall be UL 1449 labeled as Type 1 or Type 2 intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed over-current protective devices do not meet the intent of this specification.

C. SPD shall be UL 1449 labeled with 20kA I-nominal (I-n) (verifiable at UL.com) as recommended for UL 96A Lightning Protection Master Label and NFPA 780.

D. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

E. SPD shall be UL 1449 listed and labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

F. SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

G. If a dedicated breaker/switch for the SPD is not provided in a panelboard or switchboard, the SPD shall include an integral UL Recognized disconnect switch. Where provided, a dedicated breaker/switch shall serve as a means of disconnect for distribution SPD's.

H. The service entrance SPD shall include an integral UL Recognized disconnect switch, as a means of disconnect.

I. SPD shall meet or exceed the following criteria:

   1. Minimum surge current capability (single pulse rated) per phase shall be:

      a. Service Entrance and MCC applications (Type A SPD's on single line) :
         1.) APT Model TE_XAS with a 300kA per phase surge current capability.

      b. Distribution Panel SPDs (Type B SPD's on single line) :
         1.) APT Model TE_XDS with a 200kA per phase surge current capability.

      c. Panelbaord SPDs (Type C SPD's on single line) :

1.) APT Model TE_XCS with a 100kA per phase surge current capability.

J. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

VOLTAGE	L-N	L-G	N-G
208Y/120V	700V	700V	700V
480Y/277V	1200V	1200V	1200 V

K. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) for L-N, L-G, and N-G modes of protection (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277V	20%	320V

L. SPD shall include a serviceable, replaceable module (excluding Distribution and Panelboard SPDs).

M. Service Entrance and Distribution Panel SPDs shall be complimentary UL 1283 (Type 2 applications) listed for EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

N. SPD shall have a warranty for a period of ten (10) years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

O. Service Entrance SPDs shall be equipped with the following diagnostics providing MOV or TPMOV status indication:
   1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
   2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
   3. Form C dry contacts
   4. Surge Counter
   5. No other test equipment shall be required for SPD monitoring or testing before or after installation.

P. Distribution Panel and Panelboard SPDs shall be equipped with the following diagnostics providing MOV or TPMOV status indication:
   1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
   2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
   3. Form C dry contacts.

4. Surge counter.
5. No other test equipment shall be required for SPD monitoring or testing before or after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall meet the following criteria:
   1. Install per manufacturer's recommendations and contract documents.
   2. Install units plumb, level and rigid without distortion
   3. One primary suppressor shall be installed external to the service entrance in accordance with manufacturer instructions.
   4. Service Entrance SPD shall be installed on the line or load side of the main service disconnect.
   5. Service Entrance SPD ground shall be bonded to the service entrance ground.
   6. One SPD shall be installed external to each designated panelboard.
   7. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
   8. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
   9. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.
   10. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect.
   11. Panelboard SPDs shall have an independent means of servicing disconnect such that the protected panel remains energized.

3.2 ADJUSTMENTS AND CLEANING

A. Remove debris from SPD and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.3 TESTING

A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.

B. Check all installed panels for proper grounding, fastening and alignment.

END OF SECTION

SECTION 26 5100

INTERIOR/EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Exterior luminaires, lamps, and ballasts.
6. Poles and accessories.

B. Related Sections:

1. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including relay panels, photoelectric relays, and occupancy sensors.
2. Division 16 Section "Wiring Devices" for manual switches.

C. Work Included: The extent of lighting fixture work is as shown and scheduled, as indicated by the requirements of this Section, and as specified elsewhere in these Specifications.

D. Intent: It is the intent of these specifications to ask for a completed lighting fixture installation by the Contractor. Completed means lamped, cleaned, adjusted, tested and ready for occupancy and operation in accordance with the above paragraphs and in accordance with the other sections of these specifications.

E. Furnish, assemble, install, and wire up complete, all lighting fixtures including those for general illumination, special lighting, exit sign, emergency lighting and exterior lighting, except where otherwise indicated on the Drawings. Fixtures shall be complete with lamps, lamp holders, and all necessary accessories. Fixtures shall bear the Underwriters' Laboratories, Inc. label of approval and be purchased, wired, and installed in accordance with applicable codes.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LED: Light Emitting Diode

F. LER: Luminaire efficacy rating.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting fixture, including ballast housing if provided.

I. Pole: Luminaire support structure, including tower used for large area illumination.

J. Standard: Same definition as "Pole" above.

1.4 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of fixture designation. Each submitted item shall be clearly marked indicating the fixture type according to the fixture schedule on the drawings. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF and energy-efficiency data.
4. Lamps, including life, output (CCT, CRI, lumens), and energy-efficiency data.
5. Photoelectric relays.
6. Materials, dimensions, and finishes of poles.
7. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
8. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.

b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. 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.

C. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

D. Warranty: Sample of special warranty as applicable.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

E. Provide fluorescent ballasts which comply with Certified Ballast Manufacturers' Association (CBM) Standards and carry the CBM mark on the label.

F. Comply with IEEE C2, "National Electrical Safety Code."

G. IESNA LM-79, Electrical and Photometric Measurements of Solid-State Lighting Products.

H. IESNA LM-80, Approved Method for Measuring Lumen Maintenance of LED Light Sources.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One case of each type and rating installed.
2. Ballasts: One for every 50 of each type and rating installed.

1.10 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated. In AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is **150 mph or the speed promulgated and enforced by the local jurisdiction.**

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 25 years.
c. Velocity Conversion Factors: 1.0.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings, and as specified in Div 16 Specifications.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. General: All fixtures shall be as indicated and scheduled on the Drawings. The omission of a type or quantity in the fixture schedule shown on the Drawings will not relieve the Contractor of the responsibility for furnishing all fixtures indicated on the Drawings.

B. Provide lighting fixtures, of the size, type, and rating indicated, complete with, but not necessarily limited to, lamps, lampholders, reflectors, ballasts, starters, and wiring.

C. Provide required dimensional thickness of metal, plastic and composite materials so that all fixtures are rigid, stable and will resist deflection, twisting, warping under normal installation, and relamping procedures. All materials shall be non-corroding or shall be treated in such a manner to resist corrosion in the actual environment where they will be installed.

D. Provide neoprene, silicone, rubber, or other appropriate gasketing, stops, and barriers where required to prevent light leak, control sound and vibration, prevent water leaks and water vapor penetration.

E. Provide finished product with the following minimum qualities:

1. Ground and/or burr free metal edges.
2. Tight fitting connections, hinges and closures.
3. Clean neat corners, edges, trims and frames

F. Finishes:

1. Fixture finishes shall be applied in a manner that will assure a durable wear resistant surface in an indoor or outdoor environment as it may be. Further, finishes are to be applied in such a manner so that corrosion resisting properties of those finishes will not be compromised after both fabrication and installation of the fixture has been completed and the fixture is operated in the manner for which it was intended.
2. Prior to finishing, all surfaces must be free from foreign materials such as dirt, rust, oil, polishing compounds and mold release agents
3. Where necessary surface cleaned by accepted chemical means shall receive corrosion inhibiting (phosphating) treatment assuring positive paint adhesion

G. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

H. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

I. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

J. Metal Parts: Free of burrs and sharp corners and edges.

K. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

L. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

M. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

N. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

O. All lighting fixtures shall conform to all applicable UL standards and shall be UL labeled.

P. Catalog numbers are for general identification of fixtures only. All related parts, such as plaster rings, junction boxes, louvers, shields, mounting stems, canopies, connections, straps, nipples, etc., to fit them properly to the construction, shall be furnished and installed.

2.3 GENERAL REQUIREMENTS FOR EXTERIOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

   a. "USES ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

2.4 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 20kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8: Comply with ANSI C82.11 and the following:

1. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

F. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic or electromagnetic type rated for 0 deg F starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.

G. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

H. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 10 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

I. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.5 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.

4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.6 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate two fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.7 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F.
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F.
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

2.8 QUARTZ LAMP LIGHTING CONTROLLER

A. General Requirements for Controllers: Factory installed by lighting fixture manufacturer. Comply with UL 1598.

B. Standby (Quartz Restrike): Automatically switches quartz lamp on when a HID lamp in the fixture is initially energized and during the HID lamp restrike period after brief power outages.

C. Connections: Designed for a single branch -circuit connection.

D. Switching Off: Automatically switches quartz lamp off when HID lamp strikes.

E. Switching Off: Automatically switches quartz lamp off when HID lamp reaches approximately 60 percent light output.

2.9 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.10 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.11 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2850 initial lumens (minimum), CRI 80 (minimum), color temperature 3500K, and average rated life 20,000 hours unless otherwise indicated. (Provide per Luminaire Schedule)

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1350 initial lumens (minimum), CRI 80 (minimum), color temperature 3500 K, and average rated life of 24,000 hours unless otherwise indicated. (Provide per Luminaire Schedule)

C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated. (Provide per Luminaire Schedule)

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.12 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000K. (Provide per Luminaire Schedule)

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K. (Provide per Luminaire Schedule)

2.13 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.14 LED SYSTEMS

A. Compliance: Modules shall be UL recognized components, indoor luminaires shall be UL listed for 25 degrees C. ambient environments, RoHS compliant, and LED modules shall comply to LM-79 and LM-80 standards.

B. End of Line Testing: LED Manufacturing facility shall perform end of line pass/fail test of all components for color temperature, luminous output and wattage.

C. Warranty: LED modules and drivers shall be warranted for 5 years.

D. Drivers: LED drivers shall be class 2, DC constant current (voltage appropriate to LED module).

E. Electronic drivers shall be available for 120-277V applications.

F. Dimming shall be available in either line voltage or 0-10 low voltage control, as required by project documents.

G. Rated Life: 50,000 hours per IESNA L70 standard, 70% lumen maintenance over life.

H. Traceability: Modules shall be tracked by manufacturer by sales order to ensure proper color and lumen output match for future replacements.

I. Components: Discrete LED's shall be configured into arrays via series/parallel matrix to avoid string outages. Connectors shall be located below LED surface to avoid shadows.

J. LED drivers shall have power factor greater than 90% and THD less than 20% of full load.

K. Units provided with integral 10kV surge suppression protection shall be tested in accordance with IEEE C62.41.2 and ANSI standard 62.41.2.

L. LED's shall be available in 3500 to 5000K (or as per project documents) with a CRI ≥ 85.

M. Auto resetting: Thermal protected LED's shall turn off when safe operating temperatures are exceeded.

N. Manufacturers of LED luminaires shall demonstrate a suitable testing program incorporating high heat, high humidity and thermal shock test regimens to ensure system reliability and to substantiate lifetime claims. The use of IESNA LM-80 data to predict luminaire lifetime is not acceptable.

2.15 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.16 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

F. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Color: As specified or As selected by Architect from manufacturer's full range.

2.17 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
2. Finish: Same as pole.

E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Color: As specified or As selected by Architect from manufacturer's full range.

2.18 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

G. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

H. Light Fixture whips shall be 6 feet long minimum.

I. Standards: Comply with NEMA standards, applicable requirements of the NEC pertaining to installation of interior lighting fixtures, and with applicable portions of the NECA's "Standard of Installation".

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric devices to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

D. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

E. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 16 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.5 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 16 Section "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency power source and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

D. Inspect each installed fixture for damage. Replace damaged fixtures and components.

3.7 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

3.9 FIELD QUALITY CONTROL (SITE LIGHTING)

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-64, "Photometric Measurements of Parking Areas."
b. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.10 FINAL INSPECTION

A. Upon completion of the installation, lighting equipment must be in first class operating order and free from defects in condition and finish.

B. At time of final inspection, all fixtures and equipment must be installed and lamped with new lamps and be complete with all lenses, diffusers, reflectors, side panels, louvers or other necessary components.

C. Fixtures shall be completely clean and free from finger marks, dust, plaster or paint spots.

D. Any reflectors, lenses, diffusers, side panels or other parts damaged prior to the final inspection shall be replaced at no expense to the Owner.

E. Fixtures with rust or damaged housing or supports or with damaged or cracked lenses shall be replaced at no cost to the Owner.

F. Housings shall be rigidly installed and adjusted to a neat flush fit with the ceiling

G. No light leaks shall be permitted at the ceiling line or from any visible part or joints.

H. Preinspection Tasks: Immediately before final inspection, thoroughly clean all fixtures inside and out, including plastics and glassware, adjust all trim to properly fit adjacent surfaces, replace broken or damaged parts, and lamp and test all fixtures for electrical and mechanical operation. Any fixtures, or parts of fixtures, which have begun to show signs of rust or corrosion at the time of completion of the job, shall be removed, and replaced with properly protected metal parts.

END OF SECTION

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SECTION 27 0500

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

B. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions reviewed by the Engineer, or for deviations from requirements in the Contract Documents. Understand clearly that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So 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. Prepare and submit a complete set of Construction Coordination Drawings utilizing the dimensions of the actual equipment to be utilized and indicating the exact routing for all elements such as piping, cable tray, conduit, ductwork, fire sprinkler lines, etc., including conduit embedded in concrete, and paying close attention to sloped plumbing lines such as sanitary and storm sewer. Use the architectural and structural drawings as the base drawings to which all trades shall add their work.

Provide Plan Views as well as sufficient Elevations and Sections to assure and demonstrate installation sequencing, access, and space coordination upon review. Complete each Coordination Drawing and include on the drawing sign-off by each individual trade performing work in the affected area, as well as the Contractor. No work shall commence in the area covered by the specific drawing until review and acceptance of drawing. This requirement for Coordination Drawings is not authorization for the Contractor or individual trades to make any unauthorized changes to the Contract Drawings. Maintain all Design Drawing space allocations such as ceiling heights (maintaining an eight (8) inch high zone directly above the ceiling for flexibility), chase wall dimensions, equipment room sizes, etc., unless prior written authorization is received from the Architect to deviate.

Work installed by a trade which interferes with work of any other trade will be corrected at no cost to the Owner.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 TESTS

A. Contractor is to coordinate, furnish, and pay for all required and specified testing.

3.5 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

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SECTION 27 1100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.
6. Rack mounted power protection and power strips

B. Related Sections:
1. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. ER: Equipment Room

C. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

D. LAN: Local area network.

E. RCDD: Registered Communications Distribution Designer.

F. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

G. TR: Telecommunications Room

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
4. Qualification Data: The contractor is required to be currently listed as a registered Manufacture Certified Installer and provide personnel for telecommunications installations who are certified.
5. The Contractor shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective submittal has been approved by the Owner. Such work shall be in accordance with approved submittals.
6. Proposed product data sheets: 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.
7. ER and Telecommunications Room Equipment Layout: Contractor shall submit shop drawings (floor plan and elevations) of each equipment and telecommunications room prior to installing connecting hardware, termination equipment, racks, cabinets, cable tray or other systems in the rooms.
8. Record Drawings: Furnish CAD drawings of completed work including cable ID numbers following the labeling standards. Submit in hardcopy (two full size and two half size) and electronic formats.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. The Contractor shall submit references and other related evidence of installation experience for a period of three years prior to the issue date of this Specification.
2. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of registered Manufacture Certified Installer.
3. All work shall be supervised on-site by a BICSI Registered Communications Distribution Designer (RCDD). Must demonstrate knowledge and compliance with all BICSI, TIA/EIA, UL, and NEC standards and codes. Contractor shall submit proof of RCDD designation.
4. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
5. Field Inspector: Currently registered by BICSI as Commercial Installer to perform the on-site inspection.

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. Provided products shall meet the following requirements: Items of the same classification shall be identical. This requirement includes equipment, assemblies, parts, and components.

F. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

G. 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 90percent relative humidity, non-condensing.
2. Interior uncontrolled environment: 0 to 130 degrees F dry bulb and 10 to 95percent relative humidity, non-condensing.
3. Exterior environments: Minus 30 degrees to 130 degrees F dry bulb, and 10 to100 percent relative humidity, condensing.
4. Listing and Labeling: Provide products specified in this Section that are listed and labeled, as defined in the NEC Article 100.

H. Standard products:

1. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of specified products and shall be the manufacturer's latest standard design.
2. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

B. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate layout and installation of communications equipment and cabinets with special systems subcontractors and other trades, including mechanical, electrical and plumbing, and with telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

C. Coordinate with all contractors providing equipment outside the scope of this contract.

1.8 DELIVERY AND STORAGE

A. Equipment shall be delivered in original packages with labels intact and identification clearly marked.

B. Equipment shall not be damaged in any way and shall comply with manufacturer's operating specifications.

C. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support in ER/TR Rooms: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

D. Primary Industry Standard Requirements for Telecommunication Room Fittings:

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA-569-B
3. Comply with TIA/EIA-568-B.1 & B.2
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70

E. Coordination with Other Trades:

1. Power
2. Lighting
3. HVAC
4. Fire Suppression

2.2 BACKBOARDS

A. Backboards: Walls shall be AC-grade plywood, 3/4 by 48 by 96 inches around the perimeter of the room. Plywood shall be fire-rated and treated on all sides with at least two coats of white, (non-gloss) fire resistant paint. The bottom of the plywood shall be mounted 18 in. AFF (above finished floor). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved:

1. ADC.
2. Aim Electronics; a brand of Emerson Electric Co.
3. AMP; a Tyco International Ltd. company.
4. Cooper B-Line, Inc.
5. Hubbell Premise Wiring.
6. KRONE Incorporated.
7. Leviton Voice & Data Division.
8. Middle Atlantic Products, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Ortronics, Inc.
11. Panduit Corp.
12. Siemon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.

4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Rack mounting.
2. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
3. LED indicator lights for power and protection status.
4. LED indicator lights for reverse polarity and open outlet ground.
5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
7. Cord connected with 15-foot] line cord.
8. Rocker-type on-off switch, illuminated when in on position.
9. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Each communication room depicted in the drawings shall be provisioned with a Telecommunications Grounding Busbar (TGB) meeting or exceeding the following requirements:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression -type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, Minimal bar size is ¼” thick x 2” wide x 10” long with 9/32-inch holes spaced 1-1/8 inches apart.
3. The TGB’s shall be electroplated and pre-drilled for connector attachment to 6 AWG ground cables.
4. Each bar shall be installed with isolated standoff mounts.
5. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. All grounding material and work shall comply with the National Electric Code (NEC Chapter 8), Local and State regulations as well as ANSI-J-STD-607-A.

D. A #6 AWG stranded copper wire cable shall be extended between TR’s Telecommunications Ground Busbars (TGB) and the Telecommunications Main

Grounding Busbar (TMGB) (located in ER) via conduit and cable tray systems as shown on the drawings.

E. Ground conductor shall be provided, installed and utilized for equipment, termination, cable tray, equipment rack and computer equipment grounding, including telephone systems.

F. Coordinate with the electrical power trades for grounding wiring interface to an approved connection to the building electrical power service panel ground source. Provide #6 AWG stranded copper bonding conductor extending from the electrical ground source to the Telecommunication Main Grounding Busbar (TMGB) located in the ER.

G. Provide ground cable #6 AWG stranded copper bonding conductor installed from the TMGB to each of the TR's as depicted in the project drawings ground wiring riser diagram.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

A. If the station conduit route exceeds the 180º of total bends limitation, an appropriate sized junction box is required within a straight section of the conduit run.

B. Each station conduit run requires a separate junction box.

C. The sharing of a junction box by multiple conduits is prohibited.

D. A junction box shall not be used in place of a bend.

E. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

F. Communication Devices and Accessories:

1. Box shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 6 Augmented), STP (150 ohm), fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting.
2. Furnish and install a 4" square box with a single gang plaster ring and a EMT conduit system to the nearest horizontal distribution cable tray, conduit system, or non-continuous support system for wall phones, wireless access points, mechanical and electrical metering equipment.

4. Furnish and install a continuous EMT conduit system from the telecommunications outlet to the cable tray in inaccessible and semi inaccessible areas.

G. Telecommunications Outlets

1. New construction telecommunications outlets shall be installed 18” AFF unless specified.
2. The telecommunications outlet box will be a 4”x4” square box fitted with a single gang mud plate.
3. The telecommunications outlet shall be provisioned minimum with a 1.25” EMT conduit that has bushings installed and a measured pull line installed and secured at the conduits terminations points.
4. Extend 1.25” conduits from outlet box top to 6 in. above nearest cable tray.
5. Telecommunications outlets are not to be installed back to back.
6. Firestop the outlet box using a listed UL application in firewalls.
8. Run conduit in the most direct route possible.
9. The use of flexible metallic conduit is not permitted.
10. Cable service loops within TOs shall be adequate to permit installation and removal of device for inspection without damage to cable or connections.
11. Dust caps are to be placed over the terminated cabling at the back of the patch panel or TO.

H. Floor Boxes

1. Floor boxes and covers shall be heavy duty in construction, watertight and easily accessible.
2. Furnish and install a 1.50 in. EMT conduit to each floor box.
3. Floor boxes are to be furnished with protective covers for data ports.
4. Floor box options shall accept both brass and nonmetallic cover plates and flanges.
5. Flanges for both brass and nonmetallic shall be available in one-, two-, and three gang applications and installed on boxes. Each flange shall provide 1/2-inch of adjustment to accommodate various floor coverings and wood/concrete depths.
6. Flanges shall accommodate connectivity outlets and modular inserts.
7. Modular inserts shall snap directly into each flange through the use of a mounting bezel

2.8 TERMINATION EQUIPMENT RACKS

A. Intrabuilding cable patch panels used for both Intrabuilding Cable and Horizontal Cable termination, wire managers, and electronic equipment, will be mounted in standard 19-inch x 7-foot aluminum equipment racks with 6 inch wide, side mount vertical cable management hardware, horizontal cable management, shelves and other accessories as required.

B. Any array of two racks shall have three vertical cable managers.

C. An allowance of -50 percent vacant rack unit space shall be provided in all IT rooms.

D. Equipment racks shall be supported and braced by overhead Cable Runway (Ladder Rack).

E. Each rack and cabinet shall be mounted on an isolation pad and utilize non conductive washers to secure the rack to the floor.

F. Racks and cabinets shall be grounded to the isolated ground bar within the Room using a standard ground lug and #6 green jacketed cable ground wire.

G. The following are approved manufacturers:
   1. Middle Atlantic
   2. Hubbell
   3. Panduit
   4. CPI

2.9 TERMINATION EQUIPMENT CABINETS

A. Equipment cabinet shall be 19-inches wide, 7 feet tall, and have a 44-RU capacity equipped w/ shelves vertical and horizontal cable management as required to support cable.

2.10 EQUIPMENT FRAME INSTALLATION

A. Provide equipment racks as per drawings.

B. Provide a junction plate at top of equipment rack and required cable runway to attach rack to cable runway.

C. The completed equipment frame will be affixed to the floor using drop-in anchors and 5/8-inch zinc-plated hex bolts. The anchors will be sheathed with an isolation sleeve and isolation pads under each rack. The rack will be anchored with split and flat washers 5/8 inch nylon slip stop nuts.

D. Grounding of equipment racks shall include scraping of paint off grounding points on rack, installer must use sheathed six gauge grounding wire with home runs from each rack grounding point to the bus bar located in the ER/TR.

E. Place the equipment frame in the TR to ensure that it is aligned with existing equipment frames, or such that the “front” mounting holes on the channels of the equipment frame are installed with the long axis 4 feet from the parallel wall, and space allowing, 3 feet from any adjacent wall. This is to ensure at least 36 inches of clearance completely around the equipment frame once termination and electronics are installed in the equipment frame.

F. Cable Termination Hardware

1. Multipair Copper Backbone cable shall be terminated on 110-style termination blocks attached to the plywood backboard.
2. Category 6 Augmented UTP cables shall be installed as "home runs" from the TR to each outlet it serves and shall be terminated at 24, RJ-45 style patch panels. These patch panels shall be 1 RU in height. Spare ports of 30% growth shall be provided.

G. Patch Panels

1. Use 24 Port Patch Panel, with horizontal wire management (Front and Back) for ER/TR Cat 6 Augmented cabling terminations.
2. Use 24 Port-Power Over Ethernet (POE)- Patch Panel, with horizontal wire management (Front and Back) for ER/TR Cat 6 Augmented cabling terminations for terminating all wireless access points (WAPs) and cameras where required.

H. Wire Management

1. Equipment Rack Horizontal Wire Managers shall be black with Velcro Ties, 1 or 2 RU in size.
2. Equipment Rack Vertical Wire Management shall be black, dual sided, 6 in.
3. Wallboard Wire Managers shall be standard 4" D rings for cable routing between wall fields as required.
4. Include vertical cable manager in between and on both sides of equipment rack.

J. Patch Panel Installation

1. Wire management to be mounted at the top and bottom of station cabling equipment racks and between every patch panel.
2. Wire management to be installed at top and bottom of fiber and network equipment rack at top and bottom, and between every FDU and network switch.

L. Faceplates and Connectors

1. The standard work area Telecommunications Outlets (TO) typically consists of 4 or 2, Category 6a cables.
2. Wireless TOs mounted in ceilings shall have 2, Cat 6 Augmented cables.
3. Security Camera TOs shall have 2, Cat 6 Augmented cables.
4. Floorbox TOs in conference rooms shall have 4, Cat 6 Augmented cables.
5. Standard work area Telecommunications Outlets (TO) modules/inserts with 45 degree blue angled jacks, white faceplates, and white blanks.

2.11 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide one rack mounted 3,000 VA UPS for each rack/cabinet in each ER and TR. VA rating is available capacity after 10 minutes of operation at 100% load.

B. UPS shall have an output voltage of 120 volts AC.

C. UPS shall have an input voltage of 208 volts AC utilizing a 30-amp twist lock plug.

D. UPS shall have 20-amp and 30-amp receptacles.

E. UPS shall have internal battery capable of supporting full-load for a minimum of 10 minutes.

F. The following are approved manufacturers:

1. Emerson
2. PowerWave
3. Minuteman
4. Tripplite
5. APC

2.12 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the contract drawings or in this document and required to provide a complete and functional Public Wide Distribution System (PWDS) installation, shall be provided in a level of quality consistent with other specified items.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

C. Grounding: Ground communications room components per Section 260526 Grounding and Bonding for Electrical Systems.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems. "Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for appropriate level of administration including optional

identification requirements of this standard. Labels shall be preprinted or computer-printed type.

3.6 EXAMINATION

A. Verify backboards are properly installed.

B. Verify telecommunications grounding system is properly installed and tested following Section 260526.

C. Verify liquid-carrying pipes are not installed in or above voice and data system communications rooms. Do not proceed with installation in affected areas until removed.

3.7 INSTALLATION

A. Install work following drawings, manufacturer's instructions and approved submittal data.

B. Equipment Clearances

1. Clearance distances are measured from the outermost surface of devices installed in rack or mounted on wall, rather than from the rack or backboard.
2. Provide a minimum of three feet of space in front and rear of cabinets and racks.
3. Provide a minimum of one-foot side clearance in corners.
4. Provide a minimum of one-foot clearance above cable tray/ladder rack.
5. Provide a minimum of one-foot clearance above top-most item (cable tray, ladder rack or fiber trough) to any ceiling or overhead condition.

C. Rack and Cabinet Installation

1. Shall be properly positioned, leveled, ganged, anchored, grounded and powered.
2. Shall be populated as noted in drawings with termination hardware, equipment, proper patch cord lengths, and power outlets.
3. Install and anchor all racks and cabinets to floor following the drawings and manufacturer's instructions.
4. All cabinet doors shall be configured as shown in the drawings.
5. All cabinet cable entrances shall be provided with bushings.

D. Grounding: Ground communications room components per Section 260526 Grounding and Bonding for Electrical Systems.

3.8 CLEANING

A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

3.9 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted and approved, and the Owner is satisfied that all work has been completed in accordance with contract documents, the Owner will notify Contractor in writing of formal acceptance of the system.

B. Acceptance shall be subject to completion of all work and submittal and approval of full documentation as described above.

END OF SECTION

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SECTION 27 1500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Coaxial cable.
4. Multiuser telecommunications outlet assemblies.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Telecommunications outlet/connectors.
7. Cabling system identification products.
8. Cable management system.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. LAN: Local area network.

H. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

I. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

J. RCDD: Registered Communications Distribution Designer.

K. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.

L. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.

M. UTP: Unshielded twisted pair.

1.4 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 communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. 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.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For coaxial cable, include the following installation data for each type used:

   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics, including the following:

   a. Cross-connects.
   b. Patch panels.
   c. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

   a. Vertical and horizontal offsets and transitions.
   b. Clearances for access above and to side of cable trays.
   c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
   d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Samples: For workstation outlets, jacks, jack assemblies, in white, one for each size and outlet configuration and faceplates.

D. Qualification Data: The contractor is required to be currently listed as a registered Manufacture Certified Installer and provide personnel for telecommunications installations who are certified.

E. Source quality-control reports.

F. Field quality-control reports.

G. Maintenance Data: For splices and connectors to include in maintenance manuals.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

D. 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.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and

connector; including the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Connecting Blocks: One of each type.
3. Device Plates: One of each type.
4. Multiuser Telecommunications Outlet Assemblies: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support in ER/TR Rooms: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Walls shall be AC-grade plywood, 3/4 by 48 by 96 inches around the perimeter of the room. Plywood shall be fire-rated and treated on all sides with at least two coats of white, (non-gloss) fire resistant paint. The bottom of the plywood shall be mounted 18 in. AFF (above finished floor). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Belden
2. Panduit
3. Hubbell
4. ADC

B. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

   a. Communications, General Purpose: Type CM or CMG.

b. Communications, Plenum Rated: Type CMP , complying with NFPA 262.
c. Communications, Riser Rated: Type CMR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.
e. Multipurpose: Type MP or MPG.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

C. Horizontal Cable – Data

1. Horizontal Cable (cable that runs from the ICC to the workstation outlet) shall be Category 6 augmented (Cat 6a), plenum rated, 4-pair, high performance, Unshielded Twisted Pair (UTP), bare copper, polyethylene insulated conductors, with overall blue jacket.
2. Cat 6 Augmented cabling shall be terminated such that wire pair twists are maintained as closely as possible to the point of mechanical termination. No greater than 0.5. Maximum strip length shall be 1.0” or less. Maintain cable sheath to leading edge of connector block.
3. Total cable length including patch cable shall be limited to 295 feet.
4. User/equipment density including wireless access points (WAPs), shall be two (2) Cat 6a cables installed at each workstation faceplate.
5. Provide a minimum 6’ of service loop at the ICCs to be contained in the cable tray.
6. Within ICCs, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3’ for cable organization, and installed in a neat and workmanlike manner.
7. Velcro cable ties shall be tightened so as not to deform cable jackets and thus affect cable performance.

D. Horizontal Copper Cabling Installation – Data and Voice

1. The copper horizontal cabling will be terminated at the closet ICC on patch panels as per specifications in Patch Panels
2. Where patch panels are mounted in equipment racks, equally distribute cables on each side, down the vertical wire management, and into the horizontal wire management so as not to exceed wire management fill capacity.
3. Cables are to be neatly dressed with Velcro tie wraps (Plastic Wire Ties are not approved), and secured to the strain relief bars at the back of the patch panels.
4. All cables at the back of the patch panel are to be labeled as per Identification for Communication Systems.
5. Horizontal cabling shall be terminated such that wire pair twists are maintained as closely as possible to the point of mechanical termination. Usually no greater than 0.5”.
6. All terminations are to use TIA 568A wiring standards.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated, conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

G. Patch Cords: Factory-made, 4-pair cables in 48-inch lengths; terminated with 8-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.5 CONSOLIDATION POINTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. American Technology Systems Industries, Inc.
2. Chatsworth Products, Inc.
3. Dynacom Corporation.
4. Hubbell Premise Wiring.
5. Molex Premise Networks; a division of Molex, Inc.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Ortronics, Inc.
8. Panduit Corp.
9. Siemon Co. (The).

B. Description: Consolidation points shall comply with requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field:

   a. One for each four-pair UTP cable indicated.
   b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.

3. Mounting: Recessed in ceiling or Wall.
4. NRTL listed as complying with UL 50 and UL 1863.
5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.6 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Chatsworth Products, Inc.
2. Hubbell Premise Wiring.
3. Molex Premise Networks; a division of Molex, Inc.
4. Nordex/CDT; a subsidiary of Cable Design Technologies.
5. Ortronics, Inc.
6. Panduit Corp.
7. Siemon Co. (The).

B. Description: MUTOAs shall meet the requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field:

a. One for each four-pair UTP cable indicated.
b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.

3. Mounting: Recessed in ceiling or Wall.
4. NRTL listed as complying with UL 50 and UL 1863.
5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.7 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Two or Four -port-connector assemblies mounted in single or multigang faceplate.
1. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.
3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.8 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.9 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.10 CABLE MANAGEMENT SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. iTRACS Corporation.
2. Telsoft Solutions.

C. Description: Computer-based cable management system, with integrated database and graphic capabilities.

D. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.

E. Information shall be presented in database view, schematic plans, or technical drawings.

1. Microsoft Visio Professional or AutoCAD drawing software shall be used as drawing and schematic plans software.

F. System shall interface with the following testing and recording devices:

1. Direct upload tests from circuit testing instrument into the personal computer.
2. Direct download circuit labeling into labeling printer.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test single mode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters.

1. Install plenum cable in environmental air spaces.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. All cabling shall be terminated on RJ45 jacks at one end, and on copper patch panels in either the Telecommunications Room (TR) or Equipment Room (ER) at the opposite end.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. MUTOA shall not be used as a cross-connect point.
5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for UTP at least 49 feet from communications equipment room.

6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

E. Open-Cable Installation in ER/TR Rooms:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Provide group connecting hardware for cables separated into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Administration Class: Appropriate for application.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for appropriate level of administration.

E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

G. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

    a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

        1) Wire map.
        2) Length (physical vs. electrical, and length requirements).
        3) Insertion loss.
        4) Near-end crosstalk (NEXT) loss.
        5) Power sum near-end crosstalk (PSNEXT) loss.
        6) Equal-level far-end crosstalk (ELFEXT).
        7) Power sum equal-level far-end crosstalk (PSELFEXT).
        8) Return loss.
        9) Propagation delay.
        10) Delay skew.

6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

    a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is

available, make and receive a local, long distance, and digital subscription line telephone call.

b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

END OF SECTION

SECTION 27 5123.50

EDUCATIONAL INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Microprocessor-switched intercommunications and program systems with the following components:

1. Central station.
2. Intercom speaker unit.
3. Call-in switch.
4. Phones
5. Conductors and cables.
6. Raceways.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For educational intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include scaled drawings for station arrangement of built-in equipment.
3. Wiring Diagrams: For power, signal, and control wiring.

   a. Identify terminals to facilitate installation, operation, and maintenance.
   b. Single-line diagram showing interconnection of components.
   c. Cabling diagram showing cable routing.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

D. Qualification Data: For qualified Installer:
   1. Acceptable products shall be as produced by firms regularly engaged in the manufacturing of intercom systems of types, sizes, and electrical characteristics as required herein. These products shall have been in satisfactory use in similar service for not less than ten (10) years. The communications system shall be a standard product produced by a single manufacturer.
   2. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience and with service facilities within 100 miles of Project.
   3. Supplier: Authorized distributor of equipment manufacturer.
   4. Installer:
      a. Installer: The person who supervises the work under this section shall have at least 5 years of successful installation experience on projects with intercom systems installation work similar in scope and complexity to that required for this project.
      b. Company specializing in installing the products specified in this section with minimum five (5) years experience.
      c. The Installer shall be currently licensed by the Electrical Contractors' Licensing Board as a Certified Alarm System Contractor I (EF) or a Statewide, Low Voltage System Specialty Contractor (ES-069)
      d. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, an Intercom and Master Clock System manufacturer.
      e. Installing Contractor shall maintain a local staff of specialists, including a Superintendent, for planning, installation, and service.
      f. The installing Contractor shall maintain an office with license within seventy-five (75) miles of the project with capability to provide emergency service. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing educational Intercom and Master Clock Systems for at least five (5) consecutive years going back from date of bid.

E. Field quality-control reports.

F. Operation and Maintenance Data: For educational intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

   1. A record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
   2. A record of Owner's equipment-programming option decisions.

G. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions reviewed by the Engineer, or for deviations from requirements in the Contract Documents. Understand clearly that the Engineer's noting some errors but overlooking others does not grant the Contractor permission

to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.

1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems Level III Technician.

C. Source Limitations: Obtain educational intercommunications and program systems from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.

E. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of ceiling-mounted speaker microphones and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.

C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz. Comply with UL 813.

D. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

E. Contractor shall furnish and install speakers, trumpets, volume controls, clocks, administrative intercom/phones, call-in buttons, annunciators, amplifiers, racks with head-end equipment, power supplies, wiring, raceways, and all other equipment, whether specifically indicated or not, to provide a complete and properly operating system.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bogen Communications, Inc.
2. Dukane Communication Systems; part of GE Infrastructure, Security.
3. Rauland-Borg Corporation.
4. Telecor
5. Valcom
6. Simplex Grinell

2.4 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. General Performance
1. The system shall be a multi-channel global switching system. There shall be no linking within the system that would restrict or block telephone communications. System shall be capable of global switching within in a single console and with a single administrative telephone at the attendant position.
2. The system shall be installed “ready to integrate” with the Owner’s phone and voicemail system if required by Owner at a future date. “Ready to integrate” signifies that only programming and simple wiring connections shall be needed to integrate the systems.
3. System shall be capable of generating a tone based on a signal from a separate clock system.
4. System shall be able to override local sound systems, and broadcast over the local sound system speakers through the use of relays.
5. System shall be expandable to a minimum of 256 stations of communication.
6. System shall be capable of separating multiple paging zones as required by these specifications
7. Paging zones shall be as follows:
   a. 1st Floor
   b. 2nd Floor
   c. App Bay
   d. All areas

2.4 CENTRAL STATION

A. The Central station shall be microprocessor controlled units that provides the control circuitry for the system as well as the memory.

B. System shall provide a minimum of twelve (12) simultaneous full duplex conversations within the system.

C. System shall use standard dual-tome multi frequency (DTMF) signaling.

D. System shall provide full duplex telephone communications between administrative and staff telephones.

E. The system shall have a communications port for onsite and remote (offsite through internet) proper maintenance and diagnostics. Minimum diagnostic functions shall include:
   1. Check list of activity within the system.
   2. DTMF register test.
   3. I/O diagnostics to check each device connected to the system.
   4. Capability of checking and blocking each conversation.

F. The system shall be capable of maintaining system usage and operation statistics for administrator use.

G. Provide rack as necessary for mounting of head-end equipment in main equipment room.

2.5 INTERCOM SPEAKER UNIT

A. Units shall consist of 8” dual-cone speaker with 65hz to 17kHz response, heavy gauge metal basket, multi-tap transformer, and extended high frequency response. Unit shall be equal to Rauland USO188, Dukane 5A606, or Bogen S86T725.

B. Units shall have steel backboxes compatible with speakers designed to prevent resonance.

C. Round units shall have flush mount, round, white baked epoxy finish, concealed mounting studs, zinc treated steel baffles. 1’ x 2’ rectangular units shall have a ceiling mount baffle with integrated volume control accessible through front panel.

D. Wall mounted units shall be surface mounted on a flush single gang outlet box. Unit shall be equal to Rauland ACC1210, or approved equal.

2.6 CALL-IN SWITCH

A. Single-gang box with stainless-steel faceplate. Momentary contact signals system that a call has been placed. Equal to Rauland 2305CS.

2.7 PHONES

A. Desk-mounted phones shall be equal to Rauland Series TC6402 with TC4221TG digital sidecar attachment with cord and flush outlet box. Provide at locations as on plans and as directed by Owner.

B. Telephones shall have ten (10) programmable speed-dial buttons, last number redial button, call transfer "flash" button, tone or pulse dialing, non-volatile programming memory, desk or wall mountable, ADA compliant volume control, and ringer volume control. Provide as many as quantity of outlets indicated on drawings.

C. Outlets for phone shall be flush mounted with stainless steel plates with device and wiring as indicated by system manufacturer.

2.8 PAGING HORN

A. Shall be durable weatherproof construction and have 30-Watt integral driver assembly equal to Rauland 3602 or Dukane 5A296.

B. Shall be mounted on flush outlet box.

2.9 AM/FM CD MP3 PLAYER

A. The AM/FM CD MP3 PLAYER shall be Rauland MCX325 AM/FM Tuner CD Player (or approved equal). The AM/FM CD MP3 PLAYER shall be designed as a rack mounted music source for all applications that require a rack mounted music source with a line level output. The AM/FM CD MP3 PLAYER shall include a front mounted monitor speaker and a monitor switch with four positions. From the front panel the user can turn the audio completely off, send audio to only the monitor speaker, send audio to both speakers.

B. The AM/FM Tuner CD Player shall have the standard functions, including manual tune up and down, 6 presets for a total of 12 AM and 18 FM stations (AM1, AM2, FM1, FM2, & FM3), scan play, stop, track forward and track backward. It also has a liquid crystal display that shows the frequency, AM/FM status, preset station number, stereo reception status and CD Player status/functions. The MP3 player shall have the capability to record and play back recorded information.

C. The AM/FM CD PLAYER shall also be configured to accept a standard MP3 plug input on a static plate accessible from the front of the player.

D. The AM/FM CD MP3 PLAYER shall mount in any standard 19" rack. Any required power supply shall be included with the unit.

E. The AM/FM CD MP3 PLAYER shall be connected to the Paging System.

2.10 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.

B. Insulation: Thermoplastic, not less than 1/32 inch thick.

C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.

D. Minimum Shielding Coverage on Conductors: 60 percent.

E. Plenum Cable: Listed and labeled for plenum installation.

2.11 RACEWAYS

A. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Outlet boxes shall be not less than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

C. Flexible metal conduit is prohibited.

2.12 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide a rack mount UPS for each intercom rack/cabinet in the project.

B. Design Selection: APC Smart-UPS XL 3000VA RM 3U 120V or approved equal.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements:
   1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
   2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
   3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
   5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation in ER/TR Rooms:
   1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
   2. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 SYSTEM PROGRAMMING

A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Schedule tests with at least seven days' advance notice of test performance.
   2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
   3. Operational Test: Test originating station-to-station, all-call, and page messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
   4. Frequency Response Test: Determine frequency response of two transmission paths, including all-call and paging, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
   5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
      a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at paging speakers.
      b. Repeat test for three speaker microphones, and one master station microphone, and for each separately controlled zone of paging loudspeakers.
      c. Minimum acceptable ratio is 45 dB.

6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom, paging, and all-call amplifier. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
7. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.
8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.

D. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service and initial system programming.
   1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
   2. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions
B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the educational intercommunications and program systems.
   1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION

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SECTION 28 1300

ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes a security access system consisting of a Central Station, operating system and application software, and field-installed Controllers connected by a high-speed electronic data transmission network. The security access system shall have the following:

1. Access Control:

   a. Regulating access through doors.
   b. Surge and tamper protection.
   c. Credential cards and readers.
   d. Monitoring of field-installed devices.
   e. Reporting.

1.2 SYSTEM DESCRIPTION

A. System shall consist of a PC-based Central Station, located at Central Station Monitoring Service location, and CISCO Controllers, connected by CAT-6 based high-speed electronic data transmission network.

B. Network(s) connecting PCs and Controllers shall consist of one or more of the following:

1. Local area, IEEE 802.3 Fast Ethernet 10 BASE-T, star topology network based on TCP/IP.

1.3 PERFORMANCE REQUIREMENTS

A. System Network Requirements:

1. Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
2. Communication shall not require operator initiation or response, and shall return to normal after partial or total network interruption such as power loss or transient upset.

3. System shall automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.
4. Communications Controller may be used as an interface between the Central Station display systems and the field device network. Communications Controller shall provide functions required to attain the specified network communications performance.

B. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the Central Station shall include status data such as status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.

C. System Response to Alarms: Field device network shall provide a system end-to-end response time of 1 second(s) or less for every device connected to the system.

D. Door Hardware Interface: Coordinate with Division 08 Sections that specify door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Sections to function with the controls and PC-based software and hardware in this Section.

1.4 SCOPE OF WORK

A. Include all necessary wiring, cabling, labor, tools, equipment, and ancillary materials required to furnish and install a complete and operational card reader interface with the Card Access Control System.

B. Requirements are indicated elsewhere in these specifications for work including, but not limited to:

1. Electric door hardware, sensors, egress devices, and associated lock power supplies for card reader doors.

2. Arrange for local area network (LAN) connections.

3. The system shall provide management, control, and monitoring of card access and alarms as shown on the drawings.

C. Install 1 door access panel above each controlled door as shown on drawings.

D. Install 1 proximity card reader for each controller.

E. Furnish and install door contacts at each controlled door and 2 door contacts at each controlled double door.

F. Furnish and install 1 “request for exit” motion sensor at each controlled door.

G. Furnish and install all cabling and conduit as required to provide a complete, fully operational system.

H. Coordinate all door hardware specifications with ARCHITECT.

I. Provide interlocking capabilities with door operator(s) (ADO).

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

B. Shop Drawings:

1. Diagrams for cable management system.
2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
3. Wiring Diagrams. Show typical wiring schematics including the following:
1. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
2. Battery and charger calculations for Central Station and Controllers.

C. Project planning documents as specified in Part 3.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, "National Electrical Code."

C. Comply with SIA DC-01 and SIA DC-03.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient conditions of 0 to 100 deg F and a relative humidity of 20 to 80 percent, noncondensing.
2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. NEMA 250, Type 1 enclosure.

1.8 WARRANTY AND MAINTENANCE

A. The card reader hardware, and installation shall be warranted against defects and workmanship for a minimum of (60) months, covering all parts and labor, after acceptance by OWNER.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SECURITY ACCESS SYSTEM

A. Manufacturers:
1. Continental Access
2. DSX Access Systems
3. Galaxy Control Systems.
4. CISCO
5. RS2
6. Bosch Security Systems
7. IDenticard

2.3 CARD READERS

A. Power: Card reader shall be powered from its associated Controller, including its standby power source.

B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

C. Enclosure: Suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:

1. Indoors, controlled environment.
2. Indoors, uncontrolled environment.
3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

D. Display: LED or other type of visual indicator display shall provide visual status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

E. Wiegand Swipe Reader: Set up for 26-bit data cards. Comply with SIA AC-01.

F. Insert Readers: Requiring the card to be inserted from the bottom or side, powered by the Controller.

G. Touch Plate and Proximity Readers:

1. Active detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode a unique identification code number transmitted from the credential card.
2. Passive detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.
3. The card reader shall read proximity cards in a range from contact with to at least 6 inches (150 mm) from the reader.

PART 3 - EXECUTION

3.1 CONTRACTOR

A. The CONTRACTOR shall be a local installation and service organization, currently recognized as a factory authorized representative by the manufacturer of the specified system provided by the CONTRACTOR.

B. The CONTRACTOR shall provide a minimum of (3) references whose systems are of similar complexity and have been installed and maintained by the CONTRACTOR for the last (5) years.

C. At time of bid, the CONTRACTOR shall be licensed by the state or local jurisdiction to perform security work within the state. Contractors who have security licenses or permits pending shall not be considered acceptable for bidding on this project.

D. The CONTRACTOR shall assure that all personnel working on the project are registered with the state or local jurisdiction Systems Licensing Board as provided for by current state statutes.

E. At the time of bid, the CONTRACTOR shall provide satisfactory evidence of liability insurance and Workmen's Compensation coverage for employed personnel as required by law.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. Complete system diagnostics and operation verification.
2. Prepare a specific plan for system testing, startup, and demonstration.
3. Develop acceptance test concept and, on approval, develop specifics of the test.
4. Develop cable and asset management system details; input data from construction documents. Include system schematics and Visio Technical Drawings.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

B. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

C. Install LAN cables using techniques, practices, and methods that are consistent with Category 6A rating of components and that ensure Category 6A performance of completed and linked signal paths, end to end.

D. Install cables without damaging conductors, shield, or jacket.

E. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

F. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.4 CABLE APPLICATION

A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. Card Readers and Keypads:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from Controller to the reader is 250 feet, and install No. 20 AWG wire if maximum distance is 500 feet.
3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

D. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 250 feet.

3.5 GROUNDING

A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:

1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
2. Bus: Mount on wall of main equipment room with standoff insulators.
3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.

B. Using cable and asset management software specified in Part 2, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

D. At completion, cable and asset management software shall reflect as-built conditions.

3.8 FIELD QUALITY CONTROL

A. Contractor is to coordinate, furnish, and pay for all required and specified testing.

B. Perform the following field tests and inspections and prepare test reports:

1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6A tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3.9 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

1. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.10 PROTECTION

A. Maintain strict security during the installation of equipment and software. Central station hardware to be installed at central station monitoring service location.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. Refer to Division 01 Section "Demonstration and Training."

B. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials to man the control station and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.

C. Corporate management.

3.12 COMMISSIONING AND TRAINING

A. The CONTRACTOR is required to place entire system into full and proper operation as designed and specified.

B. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.

C. The CONTRACTOR shall perform final acceptance testing in the presence of OWNER’S representative, executing a point by point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified:

D. Submit documented test plan to OWNER at least (14) days in advance of acceptance test, inspection, and check-off.

E. Conduct final acceptance tests in presence of OWNER'S representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

F. Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check-off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.

G. The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

L. Provide hands-on training with operational equipment.

M. Training shall be oriented to the specific system being installed under this contract as designed and specified.

END OF SECTION

SECTION 28 2300

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Councilman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving picture experts group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. 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. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
4. UPS: Sizing calculations.
5. Wiring Diagrams: For power, signal, and control wiring.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

D. Field quality-control reports.

E. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

F. Warranty: Sample of special warranty.

1.5 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. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F and a relative humidity of 20 to 80 percent, noncondensing.
2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F] dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
3. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R enclosures.
4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph Use NEMA 250, Type 3R enclosures.
5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
6. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.
7. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

1.8 REQUIREMENTS

A. Provide one file server for every 32 cameras.

B. Provide minimum 24 TB of storage for each file server.

C. It is the responsibility of the Contractor to supply a properly operating system. All equipment, material and labor must be furnished, whether or not specifically mentioned in this project specification or shown on the System Drawing.

D. The system shall record up to 64 IP video streams at 15 images per second at 4CIF for 30 days minimum.

E. Resolution: .5 Megapixel.

F. Disk Redunndancy: RAID 5.

G. Provide managed "Power Over Ethernet" 19" rack-mounted network switches as required. Provide HP ProCurve or approved equal.

H. Provide Digital Video Management Software.

I. Provide server computer with system compatible software for administration.

J. Provide client computer with system compatible software, which shall be the user interface.

K. Provide (2) full high definition 23" LCD Monitors.

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment and materials used shall be standard components that are manufactured and used in the manufacturer's system

B. All systems and components shall have been thoroughly tested and proven in actual use.

C. All systems and components shall be provided with the availability of a toll-free technical assistance program (TAP) from the manufacturer.–The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.

D. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and nonwarranty items.

E. The digital video software shall be installed by a manufacturer certified dealer/integrator. Certification for installation shall be conducted by the manufacturer and shall provide all necessary knowledge to fulfill the systemization and deployment across diverse networks and infrastructures, as well as provide commissioning abilities at the integrator level.

F. Basis of design: Pelco.

2.2 SYSTEM REQUIREMENTS

A. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

C. Provide two 4PR UTP CAT 6A to each camera.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bosch Security Systems, Inc.
2. Panasonic Corporation of North America; Panasonic Security Systems.
3. Pelco.
4. Sony.
5. Axis.

2.3 0.5 MEGAPIXEL STANDARD DEFINITION INTEGRATED NETWORK CAMERA

A. The network camera shall offer dual video streams with up to SVGA resolution (800 x 600) in progressive scan format. The network camera shall be a compact size with a 3” class bubble, shall include a compact indoor enclosure, and come with an integrated varifocal 2.8~10 mm lens.

B. The network camera shall be capable of firmware upgrades remotely, over the network. In addition, a built-in accessory jack shall provide hardware expansion capabilities for future accessories such as two way audio or hard drive.

C. The network camera shall offer a service connector between NTSC and PAL analog video output, operated by a toggle button.

D. The network camera shall provide advanced low-light capabilities with sensitivity down to 0.12 lux in color.

E. The network camera shall support two simultaneous, configurable video streams. H.264, MJPEG, and MPEG-4 compression formats shall be available for primary and secondary streams with selectable Unicast and Multicast protocols. The streams shall be configurable in a variety of frame rates and bit rates.

F. The network camera shall support industry standard Power over Ethernet (PoE) IEEE 802.3af to supply power to the camera over the network.

G. The network camera shall use a standard Web browser interface for remote administration and configuration of camera parameters. The browser interface shall support multiscreen remote monitoring for up to 16 cameras on the same virtual local area network (VLAN).

H. The network camera shall support standard IT protocols outlined in section 2.04. In addition, the network camera shall support open architecture best practices with a published API available to third-party network video recording and management systems.

I. The network camera shall meet or exceed the following design and performance specifications.

J. CAMERA SPECIFICATIONS

1.	Imaging Device	1/3-inch, effective
2.	Imager Type	CMOS
3.	Imager Readout	Progressive scan
4.	Maximum Resolution	800 x 600
5.	Signal-to-Noise Ratio	50 dB
6.	Auto Iris Lens Type	DC drive
7.	Electronic Shutter Range	1~1/100,000 sec
8.	Wide Dynamic Range	60 dB
9.	White Balance Range	2,000° to 10,000° K
10.	Sensitivity	f/1.2; 2,850K; SNR >24dB
11.	Color (1x/33ms)	0.50 lux
12.	Color SENS (15x/500 ms)	0.12 lux
13.	Dome Attenuation	
	a. Clear	Zero light loss
	b. Smoke	f/1.0 light loss
14.	Construction	
	a. Back box	Cast aluminum and polycarbonate plastic
	b. Trim ring	Polycarbonate plastic
	c. Bubble	Acrylic plastic
15.	Finish	White
16.	Weight	0.77 lb (0.35 kg)

K. VIDEO SPECIFICATIONS
1. Compression H.264 in base profile, MPEG-4, and MJPEG
2. Video Streams Up to 2 simultaneous streams, the second stream variable based on the setup of the primary stream
3. Frame Rate Up to 30, 25, 24, 15, 12.5, 12, 10, 8, 7.5, 6, 5, 4, 3, 2, and 1 (depending upon coding, resolution, and stream configuration)
4. Available Resolutions
   a. 0.5 Megapixel 800 x 600; 4:3 aspect ratio; 30.0 ips max., 5.8 Mbps bit rate for MJPEG; 25.0 ips max., 1.6 Mbps bit rate for H.264; n/a for MPEG-4
   b. 0.3 Megapixel 640 x 480; 4:3 aspect ratio; 30.0 ips max., 3.7 Mbps bit rate for MJPEG; 30.0 ips max., 1.6 Mbps bit rate for H.264; 30.0 ips max., 1.7 Mbps bit rate for MPEG-4
   c. 0.1 Megapixel 320 x 240; 4:3 aspect ratio; 30.0 ips max., 0.9 Mbps bit rate for MJPEG; 30.0 ips max., 0.4 Mbps bit rate for H.264; 30.0 ips max.,0.4 Mbps bit rate for MPEG-4
   d. Additional 640 x 512, 640 x 352, 480 x 368, 480 x 272, 320 x 256, 320 x 176, 4CIF (704 x 480 and 704 x 576) and CIF (352 x 240 and 352 x 288)
5. Supported Protocols TCP/IP, UDP/IP (Unicast, Multicast IGMP),UPnP, DNS, DHCP, RTP, RTSP, NTP, IPv4, SNMP, QoS, HTTP, HTTPS, LDAP (client), SSH, SSL, STMP, FTP, MDNS (Bonjour)
6. Users
   a. Unicast Up to 20 simultaneous users
   b. Multicast Unlimited H.264
7. Security Access Password protected
8. Software Interface Web browser view and setup, up to 16 cameras
9. Open IP Integration Pelco IP camera API
10. Minimum Web Browser Requirements
    a. Operating System PC (Intel® Pentium® 4 microprocessor, 1.6(GHz) with Microsoft® Windows® XP, Windows Vista®, or Mac OS® X 10.4 or later
    b. Web User Interface Requires QuickTime® 7.55 or later
    c. RAM 512 MB
    d. Ethernet Card 100 Mbps
    e. Web Brower Internet Explorer® 7.0 or later, Mozilla® Firefox® 3.0 or later
    f. Screen Resolution 1024 x 768 pixels or higher, 16- or 32-bit pixel color resolution

L. ELECTRICAL SPECIFICATIONS

1. Connectors RJ-45 for 100Base-TX, Auto MDI/MDI-X
2. Cable Cat5 cable or better for 100Base-TX
3. Input Voltage PoE (IEEE802.3af class 3)
4. Power Consumption <6 W
5. Current Consumption PoE, <200 mA maximum
6. Service Port External 3-connector, 2.5 mm provides NTSC/PAL video output

7. Accessory Port Connects Pelco accessories

M. ENVIRONMENTAL SPECIFICATIONS

1. Operating Temperature 32° to 122°F (0° to 50°C)
2. Operating Humidity 20% to 80%, noncondensing

N. MECHANCIAL SPECIFICATIONS

1. Pan/Tilt Adjustment
   a. Pan 355°
   b. Tilt 180°
   c. Rotate 220°

O. CERTIFICATIONS

1. Camera shall be UL/cUL Listed*

P. MODEL NUMBERS

1. IMS0C10-1 Sarix mini indoor fixed dome network camera, 0.5 megapixel, color, 2.8-10 mm varifocal megapixel lens, white trim ring, clear dome or approved equal.

Q. OPTIONAL ACCESSORIES

1. Accessories, Supply Per Drawings as required for complete installation.
   a. IM-PMWT White pendant mount
   b. IM-WMWT White integrated wall mount

2.4 0.5 MP OUTDOOR STANDARD DEFINITION DOME NETWORK CAMERA

A. The network camera shall offer dual video streams with up to SVGA resolution (800 x 600) in progressive scan format. Color and day/night models shall be available. An alarm input and relay output shall be built in for integration with hard wired external sensors. The network camera shall provide a removable, local storage medium (Micro SD) for scheduled and event-based recording of images.

B. Color and day/night models shall be available for indoor and low-light environments.

C. The network camera shall be capable of firmware upgrades remotely, over the network. In addition, a built-in accessory jack shall provide hardware expansion capabilities for future accessories such as two way audio, hard drive, and so forth.

D. The network camera shall offer auto back focus (ABF) functionality through a push button on the camera. ABF parameters shall be configurable through a standard Web browser interface.

E. The network camera shall offer a service connector between NTSC and PAL analog video output, operated by a toggle button.

F. The network camera shall provide advanced low-light capabilities for color and day/night models with sensitivity down to 0.12 lux in color and 0.03 lux in black-white (B-W).

G. The network camera shall support two simultaneous, configurable video streams. H.264, MJPEG, and MPEG-4 compression formats shall be available for primary and secondary streams with selectable Unicast and Multicast protocols. The streams shall be configurable in a variety of frame rates and bit rates.

H. The network camera (day/night model) shall have movable IR cut filter mechanism for increased sensitivity in low-light installations. The presence or absence of the IR cut filter as well as the light level at which it is triggered shall be configurable through a Web browser.

I. IEEE 802.3af to supply power to the camera over the network. The network camera shall also offer 24 VAC power input for use where PoE is not feasible or available. 24 VAC power required for heater operation.

J. The network camera shall use a standard Web browser interface for remote administration and configuration of camera parameters including ABF. The browser interface shall support multiscreen remote monitoring for up to 16 cameras on the same virtual local area network (VLAN).

K. The network camera shall support standard IT protocols outlined in section 2.03.2. In addition, the network camera shall support open architecture best practices with a published API available to third-party network video recording and management systems.

L. The network camera shall meet or exceed the following design and performance specifications.

M. Camera Specifications

1.	Imaging Device	1/3-inch, effective
2.	Imager Type	CMOS
3.	Imager Readout	Progressive scan
4.	Maximum Resolution	800x600
5.	Signal-to-Noise Ratio	50 dB
6.	Auto Iris Lens Type	DC drive
7.	Electronic Shutter Range	1~1/100,000 sec
8.	Wide Dynamic Range	60 dB
9.	White Balance Range	2,000° to 10,000°K
10.	Sensitivity	f/1.2; 2,850K; SNR >24dB
11.	Color (1x/33ms)	0.50 lux
12.	Color SENS (15x/500 ms)	0.12 lux

13. Mono (1x/33ms) 0.25 lux
14. Mono SENS (15x/500 ms) 0.03 lux
15. Dome Attenuation
    a. Clear Zero light loss
    b. Smoke f/1.0 light loss
16. Construction
    a. Back box Cast aluminum
    b. Trim ring Cast aluminum
    c. Bubble Polycarbonate
    d. Finish Light gray powder coated

N. Video Specifications

1. Compression H.264 in base profile, MPEG-4, and MJPEG
2. Video Streams - Up to 2 simultaneous streams, the second stream. Variable based on the setup of the primary stream
3. Frame Rate - Up to 30, 25, 24, 15, 12.5, 12, 10, 8, 7.5, 6.5, 4, 3, 2, and 1(depending upon coding, resolution, and stream configuration)
4. Available Resolutions
    a. 0.5 Megapixel 800 x 600; 4:3 aspect ratio; 30.0 ips max., 5.8 Mbps bit rate for MJPEG; 25.0 ips max., 1.6 Mbps bit rate for H.264
    b. 0.3 Megapixel 640 x 480; 4:3 aspect ratio; 30.0 ips max., 3.7 Mbps bit rate for MJPEG; 30.0 ips max.,= 1.6 Mbps bit rate for H.264
    c. 0.1 Megapixel 320 x 240; 4:3 aspect ratio; 30.0 ips max., 0.9 Mbps bit rate for MJPEG; 30.0 ips max., 0.4 Mbps bit rate for H.264
    d. Additional 640x512,640x352,480x368,480x272,320x256, 320 x 176
    e. Supported Protocols TCP/IP, UDP/IP (Unicast, Multicast IGMP),UPnP, DNS, DHCP, RTP, RTSP, NTP, IPv4, SNMP, QoS, HTTP, HTTPS, LDAP (client), SSH, SSL, STMP, FTP, MDNS (Bonjour)
5. Users
    a. Unicast Up to 20 simultaneous users
    b. Multicast Unlimited H.264 or MPEG-4
6. Security Access Password protected
7. Software Interface Web browser view and setup, up to 16 cameras
8. Open IP Integration Pelco IP camera API
9. Minimum Web Browser Requirements
10. Operating System PC (Intel® Pentium® 4 microprocessor, 1.6 GHz) with Microsoft® Windows® XP, Windows Vista®, or Mac OS® X 10.4 or later
11. Web User Interface Requires QuickTime® 7.55 or later
12. RAM 12 MB
13. Ethernet Card 100 Mbps
14. Web Brower Internet Explorer® 7.0 or later, Mozilla® Firefox® 3.0 or later
15. Screen Resolution 1024 x 768 pixels or higher,16- or 32-bit pixel color resolution

O. Electrical Specifications

1. Connectors RJ-45 for 100Base-TX, Auto MDI/MDI-X Cable Cat5 cable or better for 100Base-TX

2. Input Voltage 24 VAC or PoE (IEEE802.3af class 3)
   a. Power Consumption <7 W, <40 W with heater operation
   b. Current Consumption
      1) PoE <140 mA maximum
      2) 24 VAC <510 mA without heater operation 2.5 A Maximum with heater operation
3. Local Storage Micro SD
4. Alarm Input 10 VDC maximum, 5 mA maximum
5. Alarm Output 0 to 15 VDC maximum, 75 mA maximum
6. Service Connector External 3-connector, 2.5 mm provides NTSC/PAL video output
7. Accessory PortConnects Pelco accessories

P. Environmental Specifications
1. Operating Temperature -22° to 122°F (-30° to 50°C)
2. Thermostat Operation Heater Thermostatically Controlled PoE operation 32° to 122°F (0° to 50°C) Heater operation for deicing below 32°F
3. Operating Humidity 20% to 80%, noncondensing

Q. Mechanical Specifications
1. Lens Mount CS mount, adjustable
2. Pan/Tilt Adjustment
   a. Pan 368°
   b. Tilt 160° (10° to 170°)
   c. Rotate 355°

R. Certifications

1. Camera shall be UL/cUL Listed

S. Model Numbers

1. IES0DN12-1 Pelco Sarix outdoor fixed dome network camera, 0.5 megapixel, day/night, 2.8-12 mm varifocal megapixel lens, clear dome or approved equal.

T. Optional Modules

1. Accessories, Supply Per Drawings as required for complete installation.
   a. ID-P Pendant mount
   b. SWM-WT Wall mount for pendant
   c. SWM-CAWT Corner adapter for wall mount
   d. SWM-PAWT Pole adapter for wall mount

2.5 MONITORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bosch Security Systems, Inc.
2. Panasonic Corporation of North America; Panasonic Security Systems.
3. Pelco.
4. Sony.

2.6 FULL HIGH DEFINITION LCD MONITOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bosch Security Systems, Inc.
2. Panasonic Corporation of North America; Panasonic Security Systems.
3. Pelco.
4. Sony.

B. Basis of Design: Pelco PMCL500 Series FHD LCD monitor

C. The PMCL500 Series FHD LCD monitor (or approved equal) shall the following features: VGA and digital visual interface (DVI) inputs, picture-in-picture (PIP), looping BNC output, and full high definition resolution.

D. The PMCL500 Series FHD LCD monitor shall provide a front panel that allows the user to adjust image quality, brightness, size, position, and geometry for optimal viewing.

E. The PMCL500 Series FHD LCD monitor shall have improved airflow and thermal reduction allowing for longer component life, ensuring reliability in a 24/7 security installation environment.

F. The PMCL500 Series FHD LCD monitor shall be constructed of a lightweight aluminum frame composition for desktop or wall-mount installations. Stationary and tilt wall mounts shall be available. The monitors shall provide built-in hand holds in the rear cover for easy installation and handling.

G. The PMCL500 Series FHD LCD monitor shall be compatible with industry-leading megapixel technology, providing a minimum of 1366 x 768 native resolution that is used with the latest megapixel video security cameras.

H. The PMCL500 Series FHD LCD monitor shall meet or exceed the following design and performance specifications.

I. ELECTRICAL SPECIFICATIONS

1.	Input Voltage	100 to 240 VAC, 50/60 Hz
2.	Power Consumption	
	a. PMCL523A	210 W
3.	Video Input Interfaces	2 BNC, looping; 1 S-Video, looping; 1 RGB; 1 DVI; 1 component
4.	Audio Input Interfaces	2 audio L/R, RCA jack
5.	Horizontal Frequency:	31 to 69 kHz
6.	Vertical Frequency	56 to 85 Hz
7.	Sync Format	NTSC/PAL

J. ENVIRONMENTAL SPECIFICATIONS

1.	Operating Temperature	32° to 104°F (0° to 40°C)
2.	Operating Humidity	20% to 80%, noncondensing

K. PHYSICAL SPECIFICATIONS

1.	Dimensions (without stand)	
	a. PMCL523A	4.0” D x 23.5” W x 14.8” H
2.	Unit Weight	
	a. PMCL523A	27.6 lb

L. MECHANICAL SPECIFICATIONS

1.	Native Resolution	1366 x 768 WXGA
2.	Panel Aspect Ratio	16:9
3.	Viewing Area	508 x 286 mm
4.	Pixel Pitch	0.372 x 0.372 mm
5.	Video Formats	480p, 576p, 720p, 1080i, 1080p
6.	Brightness	500 cd/m^2
7.	Contrast Ratio	700:1
8.	Backlight Type	CCFL
9.	Panel Life	50,000 hours
10.	Viewing Angle (H/V)	178°/178°
11.	Displayable Colors	16.7 million
12.	Response Time	8ms
13.	PIP	Selectable, sizeable, swappable, moveable
14.	Speakers	2 internal (5 W, 4 ohms x 2)
15.	Front Panel Controls	Menu, source, up/ down, power, and volume +/-
16.	Indicators	LED (power on/off)

M. CERTIFICATIONS

1. CE, Class A
2. FCC, Class A

3. UL/cUL listed
4. C-Tick

N. PELCO MODEL NUMBERS

1. PMCL523A 23-inch (583 mm) LCD monitor or approved equal

2.7 NETWORK VIDEO RECORDERS (NVR)

A. Description: Digital, time-lapse type, full-frame and motion recorder, with removable hard drive.

1. Recording Time: 400 hours minimum.
2. Resolution: 640 by 480 lines, minimum.
3. Programming shall include the following:

   a. Motion analysis graph.
   b. Password protection.
   c. Alarm and timer controls.
   d. Continuous recording option.
   e. Time-lapse operating modes.
   f. Search video by time, event, or motion.

4. Programming: Software updating, image archiving, and image transfer to a PC.
5. Storage: 24 TB per file server, removable hard drive. Software shall permit hot-swapping drives.
6. Compression: MPEG-4, H.264.
7. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
8. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
9. Mounting: Standard 19-inch rack complying with CEA 310-E, or freestanding desktop.

2.8 IP VIDEO SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bosch Security Systems, Inc.
2. Panasonic Corporation of North America; Panasonic Security Systems.
3. Pelco.
4. Sony.
5. Axis

B. Description:

1. System shall provide high-quality delivery and processing of IP-based video and control data using standard Ethernet-based networks.
2. System shall have seamless integration of all video surveillance and control functions.
3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-4 video. Unit shall provide connections for all video cameras, discreet sensor inputs, and control system outputs.
5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
6. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
7. Encoder/decoder combinations shall place video, and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
8. All system interconnect cables, workstation PCs, and network intermediate devices shall be provided for full performance of specified system.

2.9 SIGNAL TRANSMISSION COMPONENTS

A. Cable: UTP CAT 6A.

2.10 DIGITAL VIDEO MANAGEMENT SOFTWARE & HARDWARE

A. The digital video management software, hereafter referred to as “the system” consists of Digital Sentry® NVs version 7 (or approved equal) operating on a manufacturer certified non-proprietary third party hardware platform. The NVs software shall consist of Base software with individual Licenses in the required quantity. Licenses shall not expire or have any reoccurring cost.

B. The system shall record up to 64 IP video streams at 15 images per second at 4CIF resolution.

C. The system shall also record a limited number of individual IP video streams at MegaPixel resolution with H.264 compression.

D. System shall support automatic locating and configuring of cameras on the network.

E. An unlimited number of systems shall be connectible over a network. Each system shall contain two network interface cards: one for IP camera/encoder data, and one to connect to a network for client computer access.

F. The system shall be viewed, managed, and played back through a single user interface simultaneously with other Digital Sentry®digital video management

systems (or approved equal) through supplied DS ControlPoint client software (or approved equal) and configured through supplied DS Admin (or approved equal).

G. The software shall operate on certified non-proprietary third party hardware platform.

H. The software shall run on the Windows® XP Professional operating system for 4 and 16 channel systems and Windows® Server 2003 for 32 and 64 channel systems.

I. The system shall allow expansion of video channel capacity through a software upgrade without any hardware modification.

J. The system shall support multiple models of IP cameras including Sarix (from Pelco) (or approved equal) and multiple third party manufacturers.

K. The system shall support recording on internal server storage or optionally utilizing Pelco (or approved equal) or third party SCSI attached JBOD or RAID5.

L. The system shall optionally support a distributed architecture in which up to five systems function as dedicated video acquisition units, a single database runs on separate database management server, and all video data is stored on an external RAID or JBOD device.

M. The system shall be capable of continuous scheduled alarm/event and motion recording. Pre- and post-alarm recording shall also be available and shall be fully programmable on a per channel basis.

N. The system shall allow archival of video data to computers or SAN storage devices over a network connection with the optional DS Archive Utility. The archival schedule shall be either automatic, at user-defined intervals or manual and shall be configurable per connected camera

1. Software will be licensed based per archived recorder
2. Software will require a single archive server for search, playback, clip management and maintenance.
3. Each archive software shall support up to five recorders
4. Video shall only be copied for archive, existing video will remain on the source recorder until over-written.

2.11 CLIENT

A. A client computer with system compatible software shall be the user interface for viewing one or more systems. Live and recorded video and current event video shall be displayed on any client computer using a proper login and password. The client computer shall be able to connect to an unlimited number of recorders simultaneously to display live and recorded video.

B. Client software shall be unlicensed and available to be installed on as many clients as required by the user.

C. Client Software shall be compatible with multiple DVR and NVR platforms.

D. Client Software shall be password controlled such that password functionality set at each connected system will be recognized at the client. Password shall limit the ability to access live or recorded video as well as the ability to export video.

E. Client Software shall allow multiple monitor support for up to 4 displays per client workstation, providing virtual matrix functionality.

F. Client Software shall allow the connection of a keyboard controller to the client workstation to control camera call-up.

G. Client Software shall allow video streams to be selectable from a system tree on an individual camera, individual system, client defined local group or from predefined recorder based groups.

H. Client software shall be a tab based work environment with the ability to undock the tabs creating a virtual workspace on single or multiple monitor clients.

I. Client tabs shall include system management, live and search options. Tabs can be displayed simultaneously on the client.

1. Systems Tab shall display and sort available systems, connection status, system names, system IP addresses, custom categories. This tab shall additionally allow
   a. Manual connect and disconnect of systems to the client
   b. Virtual systems naming
   c. Auto Connecting
   d. Adding, Deleting and Editing available systems
2. Live video tab shall have the ability to be created up to 4 times on a single client workstation providing for video display combinations limited by the bandwidth of the client workstation and video streams from as many different systems. Live video tab shall provide the following functionality
   a. Quick Review which shall display recorded video from the last 1, 5, 15, 30, 60 or 90 minutes, providing near instantaneous review of recent events
   b. 1 week graphical display of recorded video
   c. Borderless display option
   d. Screen layout selection
   e. On the fly on-screen display changes including time, date, camera name, frame rate, frame size, alarm display and border indicators
3. Search video tab shall allow for the search of 1 or multiple cameras from 1 or multiple systems simultaneously. Search tab shall provide the following functionality
   a. Time and date search

b. Advanced data search with interfaced software.
c. Video export to any system accessible media including locally to HDD, CD/DVD, SD, Flash USB device or to network storage
d. Video authentication of exported video via check sum verification

4. The Client shall incorporate virtual matrix functionality whereby camera sequences may be created on the monitoring workstation with the following functionalities:
   a. Each sequence shall have a maximum of 500 cameras.
   b. Each camera in the sequence shall have its own individual dwell time, from 1 to 60 seconds.
   c. The Client shall have the capability to display recorded video with full VCR controls. This feature shall display video from multiple cameras simultaneously. The user shall be able to play video as fast as possible (all images), in real time, or by skipping a selectable number of seconds.
   d. The Client shall support simultaneous playback of up to sixteen cameras all synchronized with each other. Non-synchronous playback of multiple cameras shall not be acceptable.
   e. The Client shall support tours of multi-camera displays

2.12 SYSTEM SPECIFICATIONS

A. The system software shall meet or exceed the following design and performance specifications.

B. Video Standards NTSC/PAL

C. Video Decoding MPEG-4, MJPEG, H.264

D. Video Resolutions

1. CIF 352 x 240
2. 2CIF 704 x 240
3. 4CIF 704 x 480
4. HD Up to 5 MegaPixel (NTSC and PAL)

E. IP Camera Capacity 4, 16, 32, 64

F. Recording Rate

1. 64 Channels at 4CIF resolution 15ips
2. 64 Channels at CIF resolution 30 ips
3. 32 Channels at 4CIF resolution 15 ips
4. 32 Channels at CIF resolution 30 ips
5. 16 Channels at 4CIF resolution 30 ips
6. 16 Channels at CIF resolution 30 ips
7. 4 Channels at 4CIF resolution 30 ips
8. 4 Channels at CIF resolution 30 ips

2.13 MINIMUM SERVER SPECIFICATIONS

A. The system shall be supplied with a server meeting the following minimum specifications.

B. Motherboard Industry-standard Intel® platform, server grade

C. Processor Intel Dual Xeon® or better

D. RAM: 4 GB

E. Network Interface Card: Dual Gigabit

F. Operating System: Windows Server® 2003 or better

G. Hard Drive: At least one 7200 rpm hard drive (SCSI or SATA)

H. Drive Controller Card Required

I. DVD-RW Required

J. Operating System Partition Size

1. Standalone NVs 20 GB
2. Distributed NVs 160 GB

K. Dedicated Server Required

2.14 CERTIFIED SERVER PLATFORMS

A. IBM IBM® E-server xSeries®

1. (model #884031U) with SCSI drives and
2. robust SCSI controller

B. Dell Dell® PowerEdge® SC 1425 with SATA

1. drives and standard drive controller on
2. motherboard

C. Hewlett-Packard HP ProLiant Server (models DL380 or DL360)

2.15 CLIENT COMPUTER MINIMUM REQUIREMENTS

A. The system shall be supplied with one client computer meeting the following minimum specifications.

B. Processor - Intel Dual Quad Core Intel Xeon Processors E5504 2.0GHz, 4M L3, 4.8GT/s 64 Bit processor shall be supplied

C. Internal Memory: 4GB RAM, DDR3 Memory, 1066MHz, ECC (4 DIMMS)

D. Video System: 512MB NVIDIA Quadro NVS 420 with DirectX 9.0

2.16 MODEL NUMBERS

A. DS-NVS-NC DS NVs Base Software or Approved Equal

B. IP Camera Licenses

1. *(Required for Each Connected IP Camera)*
2. DS-SW-CAM-P IP camera license for Pelco cameras (or approved equal)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Install cables in raceways unless otherwise indicated.

1. Except raceways are not required in ER/TR equipment rooms at panels/racks/enclosures.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment

enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. For LAN connection and fiber-optic and copper communication wiring, comply with Division 27 Sections "Communications Backbone Cabling" and "Communications Horizontal Cabling."

F. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras level and plumb.

B. Install cameras with 84-inch- minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

C. Set final camera position to obtain the field of view required for camera. Desired field of view for each camera shall be verified by the Engineer. Connect all controls and alarms, and adjust.

D. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

E. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Contractor is to coordinate, furnish, and pay for all required and specified testing.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. 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.

D. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct

tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

a. Prepare equipment list described in "Submittals" Article.
b. Verify operation of auto-iris lenses.
c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
e. Set and name all preset positions; consult Owner's personnel.
f. Set sensitivity of motion detection.
g. Connect and verify responses to alarms.
h. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. Video surveillance system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: At no cost to the Owner: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.

B. Provide a written report of adjustments and recommendations.

3.6 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION

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SECTION 28 3111

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Digital alarm communicator transmitter.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

C. NRTL: Nationally Recognized Testing Laboratory.

1.4 SYSTEM DESCRIPTION

A. General: Furnish and install a complete and properly operating non-coded Multiplex addressable/voice communication Fire Alarm System electrically supervised and arranged for sounding an evacuation alarm throughout the building upon receiving an alarm initiated from any of the manual or automatic initiating devices.

B. Description of work: The extent of the fire alarm system work is as shown and scheduled and includes, but is not limited to, providing a system with the following functions and operation:

1. System shall include, but not be limited to, all control panels, power supplies, amplifiers, microphones, alarm initiating devices, audible and visual alarm

devices, auxiliary control relays, conduit, wire, fittings, and all components required for the system to perform as specified and indicated.

2. System shall operate as a noncoded, continuous ringing system which will have zoned audible/visible circuits.
3. System shall be wired as a Class B system for signal initiating circuits and audible/visible Alarm circuits.

C. The following table is provided to identify the typical operation required by the respective fire alarm systems.

Table Reference Notes:

(1) For each Air Handling Unit and its respective zone, upon detection of smoke (or heat) by any associated smoke (or heat) detector (Return, Supply, In-Duct, or spot detector), within the area served by the air handling unit: The Air Handling Unit shall shut down and all associated smoke dampers (In-Unit, In-Duct, or Through-Wall) shall close.

(2) Provide associated elevator recall and shunt trip functions in compliance with ASME A-17.1. elevator code.

OUTPUT → / INPUT DEVICE ↓	Sound general building alarm-Activate notification circuits	Indicate at FACP and all annunciator(s)	Close all dampers associated with affected Air Handler system and associated area (1)	Shut down affected air handler (1)	Recall elevator (2)	Initiate elevator shut down and disconnect elevator power	Release All Motorized and Electro-Magnetically Held Doors On Floor of Alarm	Release approved Security/control Door Locks	Activate smoke Control Sequence of Operations	Disconnect fuel source from cooking equipment under hood	Silence Notification Circuits	Return System to Normal
Manual Pull Station	X	X					X	X	X			
Area Smoke/Heat Detector	X	X	X	X			X	X	X			
Duct Smoke Detectors		X	X	X			X	X	X			
Elevator Lobby Smoke Detector	X	X			X							
Elevator Shaft Smoke/Heat Detector	X	X			X							
Elevator Machine Room Smoke/Heat Detector	X	X			X	X						
Sprinkler Water Flow / Pressure Switch	X	X	X	X	X		X	X	X			
Sprinkler Valve Tamper Switch		X										
F.A. AC Power Failure		X										
F.A. System Low Battery		X										
Open Circuit		X										
Ground Fault		X										
Notification Appliance		X										
Circuit Short		X										
Acknowledge Alarm											X	
Signal Silence											X	
Reset												X

1.5 SUBMITTALS

A. Manufacturer's literature describing system operation in sufficient detail to demonstrate that operational functions will be fulfilled.

B. Manufacturer's catalog information for each item of fire alarm and detection system equipment specified under "PART 2 - PRODUCTS".

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the “Documentation” Section of the “Fundamentals of Fire Alarm Systems” Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations. Indicate quantity of devices and appliances, applied to each output circuit. Indicate current required in supervision and in alarm for each system component and each output circuit. Differentiate main panel circuits and remote power supply circuits.
4. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single line connection diagram. Include all devices and components of the system on the riser diagram. Show interface with other systems.
5. Include scaled floor plans to indicate final outlet locations showing address of each addressable device. Include room/area identifications. Show any ceilings, light fixtures, HVAC openings and projections more than 8” below ceilings. Include all components of the fire alarm system, including size and route of cable and conduits.
6. Include Sequence of Operation (System Logic).

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals to items specified in Division 01 Section "Operation and Maintenance Data,” include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software (with password/access code).
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.

b. Frequency of inspection of installed components.
c. Requirements and recommendations related to results of maintenance.
d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

G. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions reviewed by the Engineer, or for deviations from requirements in the Contract Documents. Understand clearly that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

1.6 QUALITY ASSURANCE

A. Manufacturer's qualification: Firm engaged in producing complete line of fire alarm and detection system products which meets requirements of Specifications and which essentially duplicate products that have been in satisfactory use not less than two years in similar service. Manufacturer shall have authorized installer located within 25 miles of project site.

B. Installer's qualifications: Firm engaged in supervising installation and servicing of fire alarm systems who are and have been for two years prior to bid date, authorized installer of manufacturer whose system will be provided. Installer must be domiciled within 25 miles of project, employ technicians trained at manufacturer's factory, maintain stock of standard replacement parts, and service systems on contract basis. Installer's facilities to be available for inspection by Architect.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.

D. 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.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA: Comply with National Fire Protection Association (NFPA) sections NFPA 72, 90A, 101 and additional sections where applicable.

H. Firms and installers for Fire Alarm Systems shall be certified as per Act 268, Louisiana Revised Statute (LRS) 40:1664 et seg. Certified installer shall be present during installation.

I. Testing agencies: Provide products which have been tested and listed by UL and FM.

J. Reference standards:

1. NFPA 72-2010, Standard for the Installation, Maintenance and use of Local Protective Signaling Systems.
2. ADA-ABA, Accessibility Guidelines.

K. UL Listing:

1. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." Label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
2. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.

L. Guarantee and Service: Guarantee all equipment and materials for a period of two (2) years following date of acceptance.

1. During the period of guarantee any defects in equipment, materials, or workmanship shall be promptly corrected without cost to the Owner.
2. Guarantee includes equipment capacity and performance ratings specified without excessive noise levels. Any deficiencies in equipment capacity or performance specified shall be promptly corrected.

1.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.8 GUARANTEE

A. Guarantee all special system equipment free from inherent mechanical and electrical defects for a period of one year from date of building acceptance.

B. The manufacturer of the Fire Alarm system shall furnish (as part of the contract) to the owner a one year contract, effective from date of building acceptance, for maintenance and service of manufacturer's equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Edwards
2. NOTIFIER; a Honeywell company.
3. Fike
4. Fire-Lite
5. Siemens
6. Simplex Grinnell
7. Cornell

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Heat detectors in elevator shaft and pit.
7. Fire-extinguishing system operation.
8. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station. (Provisions)
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.
3. Flow switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

F. System Operation: Operating sequences shall be as follows:

1. Activation of any automatic detector on a floor, of a manual station, or sprinkler flow switch, shall cause the exact activating device to be identified on a liquid crystal display and an audible alarm at the fire alarm control panel and on a liquid crystal display and audible alarm at the remote annunciator(s), and shall initiate the following events:
   a. Activate the audible alarm signals on all floors.
   b. Activate the visual alarm signals on all floors.
   c. Shutdown the air handling units serving the floor of alarm.

G. Zone Valve Annunciation: Activation of a zone valve supervisory switch shall initiate the following events:
1. Activation of a main sprinkler system zone valve supervisory switch shall initiate a trouble signal on that sprinkler valve supervisory zone and at the remote annunciator. No building alarm shall sound.
2. Activation of a floor sprinkler system zone valve supervisory switch shall initiate a trouble signal on the alarm zone serving that floor and at the remote annunciator. No building alarm shall sound.

H. Fire Pump Annunciation: Activation of the fire pump in a running condition from the fire pump controller shall initiate an alarm signal on that fire pump supervisory zone and at the remote annunciator. Loss of power or other alarm signals from a fire

pump controller (or jockey pump controller) shall initiate a trouble signal on that fire pump supervisory zone. No building alarm shall sound.

I. Shut-Down of Air Handling Units: Activation of any manual or automatic detector, including duct detectors, shall shutdown the Air Handling Unit serving the floor in alarm.

J. Activation of a Cooking Hood Fire Extinguishing System: Hood fire extinguishing systems shall be interfaced and communicate with the fire alarm panel and, upon operation, shall activate an alarm on the panel. Electrical power required to operate the extinguishing system shall also be monitored by a supervisory alarm.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

2. Addressable initiation devices that communicate device identity and status.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
3. It shall display only those primary controls and displays essential to operation during a fire alarm condition.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72.

D. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.

a. Elevator lobby detectors except the lobby detector on the designated floor.
b. Smoke detector in elevator machine room.

c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

4. Activation of the automatic detector in the elevator area of the lobby shall initiate the following events without a time delay:
   a. Elevator doors at that floor shall close and remain closed.
   b. Elevator cars serving that floor shall return to a floor providing direct egress from the building (or to a transfer floor if the cars do not serve an egress floor). The elevator doors shall open to permit egress of passengers, close after predetermined time interval, and the elevator shall shut down.
   c. In the event of a fire on the lowest floor, the elevator cars serving that floor shall stop on a floor above the floor of fire involvement.
   d. Elevators not deactivated by automatic detectors shall remain in normal operation.
   e. Smoke detectors in the elevator area of the lobby shall be arranged to form a separate, vertical zone and cross connected into the floor zone circuit on each floor.
   f. Auto-dialer: Automatically routes alarm, supervisory, and trouble signals to a remote or central station.

E. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries; Nickel Cadmium

I. Equipment

1. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This

audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.

2. The following primary controls shall be visible through a front access panel:
    1) Eighty character liquid crystal display
    2) Individual red system alarm LED
    3) Individual yellow supervisory service LED
    4) Individual yellow trouble LED
    5) Green "power on" LED
    6) Alarm Acknowledge key
    7) Supervisory Acknowledge key
    8) Trouble Acknowledge key
    9) Alarm Silence key
    10) System Reset key

3. The following secondary control switches and LED's shall be available behind an access door:
    1) City disconnect/switch
    2) Manual evacuation (drill)
    3) Elevator bypass
    4) Door holder release bypass
    5) Manual evacuation switches (1 each per zone)

4. The control panel shall provide the following:
    1) Setting of time and date
    2) LED testing
    3) Alarm, trouble, and abnormal condition listing.
    4) Enabling and disabling of each monitor point separately
    5) Activation and deactivation of each control point separately
    6) Changing operator access levels
    7) Walk Test enable
    8) Running diagnostic functions
    9) Displaying software revision level
    10) Displaying historical logs
    11) Displaying card status
    12) Point listing

5. For maintenance purposes the following lists shall be available from the point lists menu.
    1) All points list by address
    2) Monitor point list
    3) Signal/speaker list
    4) Auxiliary control list
    5) Feedback point list
    6) Psuedo point list
    7) LED/switch status list

6. Multiple Addressable Communication Loops

a. The system must provide communication with initiating and control devices individually. All of these devices will be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
   1) Alarm
   2) Trouble
   3) Open
   4) Short
   5) Device missing/failed
   6) Device good
b. All addressable devices shall have the capability of being disabled or enabled individually.
c. Up to 127 addressable devices may be multidropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable

7. One Way Voice Communication
   a. Provide one-way voice communication and tone generating capabilities.
   b. A central audio control module shall be provided for the necessary alarm message/tone generation, main and remote microphone connections, music inputs and mixer/pre-amplifier circuits. Continuous supervision shall be provided. Audio outputs shall have individual gain control.
   c. A prerecorded audio alarm message is to be automatically activated upon fire alarm control panel receiving an alarm signal.
   d. A hand-held, push-to-talk microphone shall be provided recessed within a protective panel-mounted enclosure. The microphone shall be a dynamic communication type with a frequency range of 200 Hz to 4000 Hz and shall be equipped with a self-winding five foot coiled cable. An LED indicator shall be provided to indicate microphone push-to-talk button has been pressed and speaker circuits are ready for transmission. Microphone shall be supervised from disconnection.
   e. An audio control switch module shall be furnished to provide manual to the audio functions. These switches and associated LED indicators shall be supervised from disarrangement or failure.
   f. Audio power amplifiers shall be furnished with self-contained filtered 24VDC power supply, transformer, and amplifier monitor circuits. Amplifiers shall provide a 25 VRMS output with a frequency response of 120Hz to 12,000Hz. Provide a sufficient quantity of amplifiers to operate all system speakers simultaneously plus ten (10) percent space capacity.

8. Housing:
   a. Unit shall be housed in surface semi-flush mounted cabinet with fire alarm control panel or in separate cabinet with exactly the same appearance and external dimensions as the fire alarm control panel cabinet where shown on plans and shall be connected to 120V AC power circuit connected to the building emergency power system. Panel to include self-contained rechargeable batteries to provide standby power for a minimum of twenty-four hours and thereafter be able to sound all signals for a period of ten minutes.

9. Control Module: The Control Module shall be used to connect a supervised zone of conventional indicating devices (any 24V polarized audio/visual indicating appliance) to an intelligent loop. The Control Module shall mount in a standard 4-inch square, 2 1/8" deep electrical box. The control module may also be wired as a dry contact (form C) relay. Power for the relay coil shall be provided by the intelligent detector loop to reduce wiring connection requirements. Audio/visual power shall be provided by a separate loop from the main control panel or from supervised remote power supplies.
    a. The Control Module shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code which the control panel shall use to identify the type of device. An LED shall be provided which shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on semi-recessed outlet box. If specifically noted as surface mounted on drawings, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. The Addressable Manual Station shall connect with two wires to one of the control panel loops. The Manual Station shall, on command from the control panel, send data to the panel representing the state of the manual switch.
    a. The Manual Station shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code which the control panel shall use to identify the type of device. An LED shall be provided which shall cover flash under normal conditions, indicating that the Manual Station is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
    b. The Manual Station shall be mounted in accessible spaces and shall have the highest operable part not more than 48 inches above the floor if only a forward reach is possible or at a maximum of 54 inches if the clear floor space allows a parallel approach by a person in a wheelchair.
4. Where indicated on drawings, provide weatherproof protective shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).
3. The addressable Photoelectric Smoke Detectors shall connect with two wires to one of the control panel loops. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. The detectors shall be ceiling-mount and shall include a twist-lock base.
    a. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel.
    b. The detectors shall provide address-setting means on the detector head using rotary decimal switches. The detectors shall also store an internal identifying code which the control panel shall use to identify the type of detector.
    c. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational

and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

3. Where indicated on drawings, provide Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

E. Smoke Detector Remote Pilot Light: LED type pilot light on single gang stainless steel device plate, suitable for connecting to smoke detector to indicate smoke detector in alarm condition. Flush mount in single gang switch box.

F. Smoke Detector Remote Test Station: The Remote Test Station shall provide a means to test the duct smoke detector. It shall also include an LED which illuminates when the detector is in alarm condition and a reset switch that will return the detector to its normal state when the alarm condition has been corrected.

Mount this Remote Test Station in the hallway near unit location. Provide one test station for each duct smoke detector.

2.6 HEAT THERMAL DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. The addressable Heat Detectors shall connect with two wires to one of the control panel loops. The detectors shall use an electronic sensor to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level. The detectors shall be ceiling-mount and shall include a twist-lock base.

1. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel.
2. The detectors shall provide address-setting means on the detector head using rotary decimal switches. The detectors shall also store an internal identifying code which the control panel shall use to identify the type of detector.
3. The detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LEDs may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm. LED.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Audible/Visual Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.

2. High-Range Units: Rated 2 to 15 W.
3. Mounting: semi-recessed.
4. Matching Transformers: Tap range matched to acoustical environment of speaker location.
5. Audible/Visual Unit: Signaling devices shall consist of a speaker and a flashing strobe device. The unit shall be of modular design, finished in fire alarm red, and be suitable for surface mounting on a recessed standard 4-inch square box. Devices located outdoors shall be mounted to a cast surface box complete with gasket to insure a proper seal.
   a. Upon initiation of an alarm condition, the speakers shall activate producing an output of 87dB at 10 feet per UL464 testing criteria and the strobe device shall flash at a minimum rate of 60 times per minute. Audible must have an intensity that exceeds in spaces by at least 15dba or exceeds any maximum sound level with a duration of 60 seconds, by 6 dba, whichever is louder. Sound levels for alarm signals shall not exceed 120 dba. The effective strobe light (High Intensity) output level shall be sized per NFPA 72. Provide written proof that both the speaker output level and the strobe intensity levels meet the levels specified.
   b. The speaker and the strobe circuitry shall be electrically separate from each other. Both devices shall be electrically polarized and include a blocking network to insure the proper supervision of the signal circuit wiring. Color coded wire leads shall be provided with the strobe device. Provide screw terminals with the speaker mechanism to provide in and out wiring to the device as well as a means of providing more secure electrical connection. The speaker mechanism shall also include transient suppression circuitry to prevent noise generated by the device from being transmitted on the signal circuit wiring. The complete unit shall be UL listed as a fire alarm signaling appliance.
   c. Visual Notification Appliance description below applies to Audible/Visual Notification Appliance.

C. Visual Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens. Strobe light shall be flashing strobe lamp with white lens Unit shall be arranged for operation on a 24V DC Class [A][B] Parallel supervised signal circuit. Unit shall be surface mounted on a recessed 4" square box. The strobe light (high intensity) output level shall be sized per NFPA 72. Provide written proof that strobe intensity level meets intensity level specified.

1. Rated Light Output:

   a. 15,30,60,75,95,110 cd, selectable in the field. Provide minimum candela rating as indicated on drawings.

2. Mounting: Wall mounted unless otherwise indicated.
3. Flashing shall be in a temporal pattern, synchronized with other units.
4. Strobe Leads: Factory connected to screw terminals.
5. Mounting Faceplate: Factory finished, red.

6. The maximum pulse duration shall be two-tenths of one second (0.2 sec.) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz. The appliance shall be placed 80 inches above the highest finish floor level within the space or 6 inches below the ceiling, whichever is lower.

D. Visual Alarm Power Booster Panel: Visual Alarm Power Booster Panel shall be rated for 4.5 amps at 24 volts DC. The panels shall be U.L. listed for use with the existing Fire Alarm System, shall contain sufficient battery back-up power and shall be completely supervised. The Booster panel shall contain an addressable monitor module to annunciate at the main Fire Alarm Panel any trouble condition of the Booster Panel or field wiring. The Booster Panel shall contain at least one addressable control module for output to new visual devices. It shall have the capacity to add up to three addressable control modules as needed for expansion.

E. Any notification device denoted on the drawings with a subscript “WP” shall be rated as acceptable to be installed in a damp location.

2.8 MAGNETIC DOOR HOLDERS

A. Shall consist of two parts, a magnetic unit and adjustable armature unit.

B. Description: Units are equipped for wall mounting and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V DC.

C. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing. Remote nonzoned, supervised, visible and audible alarm annunciator(s) shall be provided as indicated on the drawings. The remote annunciator(s) shall indicate an alarm or trouble condition whenever any such condition exists at the Fire Alarm Control Panel. The audible alarm shall be silenceable, but alarm silencing shall not prevent the audible signal from resounding on subsequent alarms. If the Fire Alarm Control Panel is reset and the remote annunciator silence switch is not reset to the normal position, then the remote annunciator trouble alarm shall resound until the alarm silence switch is reset to the normal position.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Remote Annunciator(s) shall be LCD type. Alphanumeric display shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to a remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Secondary Power: Integral rechargeable battery and automatic charger.

E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

B. Provide device guards as indicated on the drawings. Provide in Gymnasiums.

2.14 FAN SHUTDOWN RELAY

A. Relay unit shall be mounted in surface cabinet. Relay shall contain a 3-pole double throw contacts rated at 10 amperes, 120 VAC and relay coil shall operate on 24V DC.

2.15 FIRE PUMP ALARM INDICATION

A. This indication shall be from dry contacts provided in the fire pump controller and connected to the fire alarm system.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. General Installation Requirements:

1. General wiring methods: Install all Fire Alarm conductors in raceways.
2. Basic electrical products: Install products such as raceways, raceway fittings, boxes, covers, conductors, and the like to comply with NEC Section.
3. Ground raceways and non-current carrying components in accordance with NEC.
4. All boxes used for Fire Alarm System shall be painted red.
5. Install system and materials in accordance with manufacturer's instructions and roughing-in drawings, and details on the Drawings.
6. System shall be installed under the direct supervision of a factory qualified fire alarm technician and in accordance with a custom prepared schematic diagram of the entire system prepared by equipment supplier. General or typical wiring instructions shall not be acceptable.
7. System shall be installed with fully supervised wiring and shall operate from the building’s Emergency Power System.
8. A complete set of the custom schematic diagram shall be included in the shop drawings submittal and as part of the "record" drawings submitted to owner at end of project. Two fold purposes of the custom schematic drawings shall

include initial installation instructions and long term maintenance reference information.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet or as recommended by the manufacturer.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

1. Smoke Detectors listed for use in air distribution systems shall be located at each story prior to the connection to a common return and prior to recirculation or fresh air inlet connection in air return systems having a capacity greater than 15,000 ft^3/min and serving more than one story.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Heat Detectors shall be installed in each elevator equipment room, in each elevator pit, and at each elevator shaft ceiling and shall be located within two feet of a sprinkler head. Each heat detector in an elevator equipment room shall cause power shutdown for all elevators served by this room. Each heat detector in an elevator shaft shall cause power shutdown for all elevators and elevator cabs located in this shaft. There shall be time delays programmed into the fire alarm system that cause delay of the shunt trip for each elevator equal to the longest travel time for that elevator.

H. Shunt trip circuit breakers sized as per NEC shall be provided wherever the fire alarm system is required to cause a power shutdown.

I. Any alarm condition shall cause a control module at each audio/video sound system to turn off.

J. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Fire-Alarm Control Unit: Flush mounted, with tops of cabinets not more than 72 inches above the finished floor.

M. Annunciator: Install flush mounted with top of panel not more than 60 inches above the finished floor.

N. Manual Stations: Mount manual stations at 4' above finished floors.

O. Wiring: All wiring shall be in conduit as specified in Sections 260533 and 260519 of the Specifications. The sizes of the different wires shall be those specified by the manufacturer. Color coding shall be used and wires shall be tagged at all junction points. Final connections between equipment and the wiring system shall be made under the direct supervision of a representative of the manufacturer. Provide 20% spare wiring between F.A. devices for future use. Provide a minimum of four (4) spare wires per conduit run. Wiring shall meet the requirements of all National, State and Local Codes.

1. Conceal fire alarm system conduit except in mechanical rooms and areas where other conduit and piping are exposed. Fasten flexible conductors which bridge cabinets and doors along hinge side and protect against abrasion. Tie and support the conductors neatly.
2. Check wiring to ensure that wiring is in accordance with the system manufacturer's wiring diagrams and that the system is free of open circuits, short circuits, and grounds

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Contractor is to coordinate, furnish, and pay for all required and specified testing.

B. Field tests shall be witnessed by Architect.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
    a. Tests of individual fire alarm devices extent:
        1) Test each and every fire alarm device connected under this contract.
        2) Description of tests: Each test shall be an operational test and shall demonstrate proper functioning of the following:
            a) Each manual station.
            b) Each automatic smoke detector.
            c) Each thermal detector.
            d) Each sprinkler water flow switch.

e) Each sprinkler valve monitor switch.
f) Each relay for shutdown of air handling systems.

3) Demonstrate to the Architect and Owner that the overall fire alarm system works properly and is complete.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Annual Test and Inspection: One year after date of Substantial Completion, at no cost to the Owner, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

I. Certification:

1. Upon completion of fire alarm system tests, submit written certification (six copies) that fire alarm system work which has been performed under this contract has been tested, is in satisfactory operating condition and that installation is in accordance with applicable codes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

B. The training session shall be given to End-User personnel responsible for operating the system, as designated by the End-User representative.

C. An invitation to attend shall be extended to representatives of the local Fire Department by the Contractor. Training session(s) shall be provided for a total of 8 hours.

3.7 COORDINATION

A. Elevators: Coordination of fire alarm recall and fire alarm horn shall be the responsibility of this Division.

B. Fire Pump and Fire Sprinkler System: Coordination of fire pump and fire sprinkler system provisions and connections shall be the responsibility of this Division.

C. Temperature Control System: Coordination of fire alarm system shutdown and start-up requirements with the temperature control system shall be the responsibility of this Division.

D. Coordination Among Trades

1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in Sequence of Operations and required by code.
2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in Sequence of Operations.
3. Smoke dampers and actuators required for transfer opening isolation are provided under Division 23. The associated detector and damper control is provided under Division 28.
4. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.
5. All smoke dampers and fire/smoke dampers shall be powered by 120-volt AC power. Interface/integrate fire alarm system as required. Verify all quantities, locations, and requirements among Fire Alarm, Electrical, HVAC, and Controls trades.

END OF SECTION

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SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Documents:
   1. Soil borings, site preparation, and pavement recommendations – herein specified as the Geotechnical Report. Copies of report available from Architect's office upon request.
      a. "Revised Geotechnical Investigation, Proposed St. John the Baptist Parish Westbank Public Safety Complex, 5733 Highway LA-18, Wallace, Louisiana, TBG Project No. 4988G", September 14, 2018, prepared by The Beta Group.

1.2 SUMMARY

A. Section Includes:

   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Temporary erosion and sedimentation control.

B. Related Requirements:

   1. Section 015000 "Construction Facilities" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of the tree or group of trees, unless otherwise indicated.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify Louisiana One Call for area where Project is located at least forty-eight (48) hours prior to beginning site clearing operations.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.

E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material for use outside of the proposed building or other structures are specified in Section 312000 "Earth Moving (Site)".

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in this section.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Construct temporary protective fencing as indicated on Drawings around trees specified to remain prior to beginning any site clearing operations. Fencing must be maintained throughout project duration.
   1. No vehicles or construction equipment shall be allowed within the perimeter of the protective fencing.
   2. Storage of construction materials, debris, or soil is prohibited within perimeter of protective fencing.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

   1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

   1. Notify Engineer not less than two (2) days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated on Drawings in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Surplus soil material and unsuitable topsoil shall be stockpiled within the property boundary and outside of the limits of construction. Stockpile location shall be determined in the field with the project owner.

END OF SECTION

SECTION 31 20 00

EARTHWORK (SITE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Documents:
   1. Soil borings, site preparation, and pavement recommendations – herein specified as the Geotechnical Report. Copies of report available from Architect's office upon request.
      a. "Revised Geotechnical Investigation, Proposed St. John the Baptist Parish Westbank Public Safety Complex, 5733 Highway LA-18, Wallace, Louisiana, TBG Project No. 4988G", September 14, 2018, prepared by The Beta Group.

C. All references to LADOTD specifications are to the Louisiana Standard Specifications for Roads and Bridges, 2016 Edition.

1.2 SUMMARY

A. Section Includes:

   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for walks, pavements, turf and grasses.
   3. Excavating and backfilling for buildings and structures.
   4. Subbase course for concrete walks and pavements.
   5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

   1. Section 312010 "Earth Moving – Building Pad" for earthwork requirements related to construction of the building or other structures.

1.3 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Select of Structural Fill: Fill material meeting the criteria established in subsequent sections, and that is suitable for placement beneath areas of proposed pavement.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698.

B. Laboratory gradation reports for specified base course and bedding course.

C. Product Data: For each type of the following manufactured products required:
   1. Geotextile fabric.
   2. Erosion control blanket.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.6 FIELD CONDITIONS

A. Utility Locator Service: Notify Louisiana One Call (811) for area where Project is located before beginning earth-moving operations.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 02231 "Clearing & Grubbing" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils for Select of Structural Fill: Clean sand or pumped sand, Soil Classification SP or SP-SM in accordance with the United Soil Classification System (USCS), with less than 10 percent passing U.S. sieve #200.

C. Satisfactory Soils for Non-Structural Fill: Soils used for fill outside of areas of proposed pavement or other structures shall be free of rock or gravel, debris, waste, frozen materials, and other deleterious matter. This material shall conform to the following criteria:
   1. Liquid Limit: 55 maximum.
   2. Plasticity Index: 10 minimum, 40 maximum.
   3. Percent Passing U.S. sieve #200: 12 minimum.

D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand in accordance with LA DOTD Standard Specification Section 1003.10.2.

2.2 GEOTEXTILES

A. Provide non-woven geotextile fabric with classification indicated on plans in conformance with LADOTD specification section 1019 and all referenced sections.

2.3 EROSION CONTROL MATERIALS

A. Erosion Control Blanket: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel-wire staples, 6 inches long (minimum).
   1. Blanket durability: 12 months (minimum).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Provide temporary pumping systems to dewater all excavations that become inundated. Dewater within 24 hours of inundation.
   3. Install a dewatering system to keep subgrades dry and to convey ground water away from excavations. Maintain until dewatering is no long required.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Do not discharge sediment-laden water into existing public or private drainage systems.

E. Remediation of compromised soils resulting from failure to comply with temporary drainage measures shall be performed with no changes in the Contract Sum or the Contract Time.
   1. Methods of remediation will be determined by the Geotechnical Engineer.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

   1. Clearance: 18 inches on each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

D. Excavations greater than 4 feet in depth shall require temporary shoring, bracing, or sheeting in lieu of unsupported trench sides.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 SUBGRADE INSPECTION

A. Notify Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll all pavement subgrades with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 20 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Proof-roll under areas of proposed walks is not required.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in opposite direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and remediate as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation as directed by the Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03300 "Cast-in-Place Concrete."

D. Initial Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

   1. Under grass and planted areas, use of satisfactory soil material is not required.
   2. Under walks and pavements, use satisfactory soil material.

C. Place select fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:

1. Under pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95> percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1½ inch.
2. Walks: Plus or minus 1/2 inch.
3. Pavements: Plus or minus 1/4 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.

2. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and the following inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material classification and maximum lift thickness comply with requirements.
   3. Determine, during placement and compaction, and at the required frequency, that in-place density of compacted fill complies with requirements.
   4. Establish optimum moisture content and stabilization ratios for the sub-base, if required.
   5. Recommend remedial measures for areas of unsuitable or unstable soils beneath proposed pavements.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing agency will determine classification of soils to be used for select of structural fill in accordance with United Soil Classification System (ASTM D2487). Atterberg Limits for the same samples shall be determined according to ASTM D4318.

D. Testing agency will determine moisture content of fill material in accordance with ASTM D2216.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area, but in no case fewer than three tests per layer for each lift.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than three tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

G. Testing agency will provide all test results to Engineer within forty-eight (48) hours of conducting each respective testing procedure.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 02300

SECTION 31 2110
EARTH MOVING (BUILDING PAD)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Geotechnical Investigation by The Beta Group, dated August 27, 2018. Geotechnical report may be obtained from Architect's office.

1.2 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for buildings.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for slabs.
   4. Excavating and backfilling for utility trenches.
   5. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:
   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 03 Section "Cast-in-Place Concrete".

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Course beneath the slab that minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
   2. Test reports on borrow material.
   3. Field density test reports.
   4. One optimum moisture-maximum density curve for each type of soil encountered.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

C. Testing & Inspection Service: Owner will engage and pay for soil testing and inspection service for quality control testing during earthwork operations. Contractor shall pay for all retesting of failed tests.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Existing Utilities: Locate existing underground utilities before performing earthwork. If utilities are to remain in place, provide protection from damage during earthwork operations.

C. Interruption of Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: **Imported soil fill material used to raise the site grade should be either a low plasticity silty or sandy clay (USCS Classification, CL) or a clayey sand (SC), shall be free of roots, construction debris, organic matter or any other deleterious materials, have a maximum clay lump size less than two (2) inches and have a liquid limit of less than 45 and a plasticity index value between 10 and 25. If a fine-grained sandy clay soil is used for select fill, close moisture content control will be required to achieve the recommended degree of compaction.**

B. Unsatisfactory Soils: Soils other than satisfactory soils.
   1. Unsatisfactory soils also include satisfactory soils not maintained within -2 to +3 percentage points of the optimum moisture content at time of compaction as determined by the Standard Proctor test (ASTM D 698A).

C. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

D. Drainage Course: Provide a stone or sand drainage layer (per list below) at contractor's option beneath the concrete slab and vapor retarder.
   1. A 4" thick layer number 8 washed gravel per ASTM C33, complying with the following gradation:

Sieve Size	Percent Passing
1/2"	100
3/8"	85 to 100
No. 4	10 to 30
No. 8	0 to 10

No. 16	0 to 5

2. A 4" thick layer of number 57 crushed and washed limestone per ASTM C33. complying with the following gradation:

Sieve Size	Percent Passing
1-1/2"	100
1"	95 to 100
1/2"	25 to 60
No. 4	0 to 10
No. 8	0 to 5

3. A 7" thick layer of clean, free draining sand free of roots, construction debris, organic matter or any other deleterious materials in accordance with ASTM C33. Sand fill shall have a maximum plasticity index of 7 in accordance with ASTM D 4318 and not more than 15% passing a No. 200 sieve, in accordance with ASTM C 117. Sand shall be placed over a continuous geotextile fabric.

E. Geotextile Fabric: Provide a Terratex N04 geotextile fabric (or approved equal) beneath a sand drainage layer. Geotextile fabric is not required beneath stone drainage layers.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. In order to prepare the building and pavement areas for fill or for insitu soils to be used as a final subgrade, the site shall be stripped of all vegetation, soft or loose surface soils, obstructions and all deleterious materials. This includes any loose or water-softened surface materials.
   1. When trees are removed, the entire root ball should be excavated such that the remaining roots measure 1 inch in diameter, or less.

C. Additional information for preparation requirements of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface, and treatment or improvement are specified in Division 2 Section "Site Clearing." Also refer to Geotechnical Investigation for additional information on site work and subgrade preparations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

E. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated materials as directed by Architect.

F. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction (including all OSHA requirements). Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Avoid opening excavations during inclement weather.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill. Alternatively, excavate the trench 6" deeper than the bottom of the pipe and provide 6" bedding course.
   3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll existing subgrade (after preparation as noted above has been completed) below the building slabs with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Contact Architect and Engineer 48 hours prior to proof- rolling. A representative of the Architect or a representative of the Engineer of Record must be on site during proof-rolling operations.
   2. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   3. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   4. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2000 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with a lean concrete fill to elevation of bottom of footings. Provide a lean concrete fill with a 28-day compressive strength of 2500 psi.

D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. All utility trenches that penetrate the building shall be effectively sealed to restrict water intrusion and flow through trenches that could migrate below the building. An effective clay "trench plug" that extends at least five (5) feet out from the face of the building exterior shall be constructed at each utility trench which penetrates the building perimeter. The plug material shall be a clay satisfactory soil compacted at a water content at or above the soils optimum water content. The clay satisfactory soil shall be placed to completely surround the utility line and be compacted.

I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under steps and ramps, use satisfactory soil material.

2. Under building slabs, use satisfactory soil material.
3. Under footings and foundations, use satisfactory soil material

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within **-2 to +3 percentage points of the optimum moisture content at time of compaction as determined by the Standard Proctor test (ASTM D 698A)**

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds the optimum moisture content allowance stated above and is too wet to compact to the specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials only after the site has been proof-rolled.

B. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

D. Compact all satisfactory soil materials to at least **95 percent of the maximum dry density as determined by the Standard Proctor compaction test (ASTM D 698A)**

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Compact grading fill materials outside of building slab limits to at least **90 percent of the maximum dry density as determined by the Standard Proctor compaction test (ASTM D 698).**

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Provide a drainage course using granular material as defined in part 2 of this specification.

B. Place drainage course on subgrades free of mud, frost, snow, or ice.

C. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. Geotextile fabric is only required for a sand drainage layer.
   2. Place drainage course 6 inches or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact each layer of drainage course to a minimum relative density of 75 percent as per ASTM D4253.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D 1557, ASTM D 2167, ASTM D 2922, ASTM D 2937 and ASTM D 698, as applicable. Tests will be performed at the following locations and frequencies:
   1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab area, but in no case fewer than 3 tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 200 feet or less of wall length, but no fewer than 2 tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 400 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and

replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect (or Engineer); reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off of Owner's property.

END OF SECTION

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SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Chemical soil treatment.

1.2 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; United States Code; 1947 (Revised 2001).

1.3 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements.

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

G. Record moisture content of soil before application.

H. Maintenance Data: Indicate re-treatment schedule.

I. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of 2 years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Louisiana.

1.5 WARRANTY

A. See Section 01 7780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.

1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
   a. Treatment shall be performed by a licensed and bonded applicator in accordance with requirements of the Louisiana Structural Pest Commission, and shall be guaranteed in writing for a period of five (5) years from time of Substantial Completion. Limits of insurance shall be minimum $50,000.00, subject to annual renewal thereafter. Warranty shall state concentrations and rates of application used.
   b. If Subterranean or Formosan termite activity is discovered in or under buildings during the Warranty period, upon notification by the Owner, the applicator shall promptly and without expense to the Owner re-treat the soil, using means acceptable to the Owner, and make good all damage caused by Subterranean or Formosan termite activity, up to the specified limits of insurance. Furnish Owner with 2 copies of Warranty.
2. Inspect annually and report in writing to Owner. Provide inspection service for 1 years from Date of Substantial Completion.
   a. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Bayer Environmental Science Corp; Product Premise: www.backedbybayer.com/pest-management.
   2. Syngenta Professional Products; Product Demon Max or ProBuild TC: www.syngentaprofessionalproducts.com.
   3. BASF; Product Termidor: www.basf.com.
   4. Substitutions: See Section 01 6300 - Product Substitution Procedures.
      a. Product selections are based on physical properties and design qualities integral to the design of the project. All substitutions must meet the criteria stipulated in this section, and the substitution must meet the aesthetic qualities and intent of the design to the satisfaction of the Architect. The Architect's decision regarding this matter is final.

B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.

C. Diluent: Recommended by toxicant manufacturer.

2.2 MIXES

A. Mix toxicant to manufacturer's instructions.

B. SOIL TREATMENT

1. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label. Product to treat against Formosa termites (Coptotermes species).

C. BAIT TREATMENT SYSTEM
1. Provide bait stations based on the dimensions of building perimeter, according to manufacturer's EPA-Registered Label for product and manufacturer's written instructions. Provide the following product:

PART 3 EXECUTION

3.1 PREPARATION

A. General: Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations. Post warning signs in areas of application.

B. Soil Treatment Preparation: Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

3.2 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.3 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

C. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

D. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes

and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

E. Masonry: Treat voids.

F. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

G. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

H. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed.

I. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

J. Spray apply toxicant in accordance with manufacturer's instructions.

K. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.

L. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

M. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

N. Re-treat disturbed treated soil with same toxicant as original treatment.

O. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.4 INSTALLATION OF BAIT-STATION SYSTEMS

A. Place bait stations according to the EPA-Registered Label for the product and manufacturer’s written instructions, in areas that are conducive to termite feeding and activity including near irrigation sprinkler heads, along drip lines of roof overhangs without gutters, and other sites and locations around the existing building as determined licensed Installer

B. Place bait stations according to the EPA-Registered Label for the product and manufacturer’s written instructions, in areas that are conducive to termite feeding and activity including near irrigation sprinkler heads, along drip lines of roof overhangs without gutters, and other sites and locations around the existing building as determined licensed Installer

3.5 CLEAN-UP

A. Upon completion of treatment work, remove from the premises all trash and debris, including wood and other foreign materials removed during preparation, related to treatment.

3.6 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

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SECTION 31 6219
TIMBER PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Geotechnical Investigation by The Beta Group dated August 27, 2018.

1.2 SUMMARY

A. Section includes round timber piles.

1.3 UNIT PRICES AND PAYMENT

A. The Contract Sum (Base Bid): Base the Contract Sum on number and dimensions of piles indicated on plans, plus not less than 12 inches of overlength.
   1. Include cost of probe piles indicated on plans in the base bid. Drive probe piles to refusal according to refusal criteria provided herein.
   2. Include the cost of the static test pile program as described under the STATIC TEST PILE section of this specification and as shown the on the structural plans.

B. Provide a unit price per pile for each alternate pile length indicated on plans.
   1. Unit prices include labor, materials, tools, equipment, and incidentals for furnishing, driving, cutting off, capping, and disposing of cutoffs.

C. No payment will be made for rejected piles, including piles driven out of tolerance, defective and/or imperfect piles, or piles damaged during handling or driving.

1.4 CONTRACTOR DUTIES

A. Notification: The Contractor shall notify the Architect and the Testing Agency 48 hours prior to commencement of driving exploratory piles and project piles. Driving of any piles must not commence without representatives of the Testing Agency being present. The Contractor shall also notify the Director of the responsible regulatory agency at the least 24 hours in advance of pile driving.

B. Provide an "As-Built" survey of pile locations as defined in the SUBMITTALS sections of this specification.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Testing and inspection services shall be conducted by the independent Testing Agency selected and paid for by the Owner. The Testing Agency employed by the

Owner shall perform testing services required by Owner for pile foundations including:

1. Perform inspections of all piles at source and at project site, and mark conforming piles for identification.
2. Logging of all driven piles as described under the SUBMITTALS section of this specification.
3. Conducting a pile load test program as defined under the STATIC TEST PILE section of this specification and in conformance with the applicable requirements of the following standards and regulatory agencies.
   a. American Society for Testing and Materials (ASTM).
   b. International Building Code, 2012 Edition.
4. Observation of pile-driving operations.
   a. All piles not driven to the required driving criteria shall be reported to the Architect immediately.
5. Vibration Monitoring.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Tension straps: Provide details of tension straps at top of piles.

B. Shop Drawings: Show fabrication and installation details for piles.
   1. Including details of driving shoes, tips or boots, and pile butt protection when driving through rock or hard driving conditions requiring protection of the pile ends.

C. Round timber pile treatment data.

D. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion for approval prior to mobilizing pile driving rig to site.

E. Static Pile Test Program:
   1. Submitting static pile test loading scheme to the Structural Engineer and Project Architect for review prior to commencing pile load test.
   2. Submit details of testing apparatus as defined under Part 3 in the STATIC TEST PILE section of this specification. These details shall be reviewed by the Structural Engineer and the Project Architect prior to commencing the pile load test.
   3. The testing agency shall record and provide to the Architect and General Contractor sufficient documentation of pile load test, such as graphs of loading versus pile movement, to fully explain how the pile reacted to applied loading. Submit report within three days of completing each test

F. Pile-driving records. Submit copies of driving record of each pile to Architect and General Contractor not later than 2 days after driving. Include project name and number, name of Contractor, pile location and number, type and size of hammer used, type of pile driving cap used, rate of operation of pile driving equipment, pile dimensions, elevation of point, elevation of butt before and after cut-off, ground elevation, continuous record of number of blows for each foot of penetration, pile

deviation, measured heave and re-strike, and any unusual occurrences during pile driving. Owner shall pay for Testing Agency Services to monitor driving operations and compile driving records.

1. The pile-driving record shall be provided as a neat, orderly, daily pile driving report.
2. The report shall identify each pile with a number that corresponds to a numbered pile plan submitted prior to the driving operations.

G. As-Driven Pile Locations: An "As-Built" survey of pile locations, performed by a Louisiana Registered Land Surveyor shall be provided by the Contractor. Piles shall be located horizontally to column lines or foundation edges and vertically referenced to finish floor elevation 1'-0".

H. Field quality-control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver piles to project site in such quantities and at such times to assure continuity of pile driving operations to project schedule.

B. Store piles in orderly groups above ground and blocked during storage to prevent distortion of members. Piles exhibiting variations beyond tolerance limits will be considered distorted and may not be used in the work.

1.8 JOB CONDITIONS

A. Site information: Data on indicated subsurface conditions are not intended as representations or warranties of such conditions. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by Contractor. The data is made available for convenience of Contractor. Geotechnical Report may be reviewed at Architect's Office.

1. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to Owner.

B. Protection of Property: The Contractor shall document the conditions of existing paving, structures, sewers, above ground utilities, buried utilities, and other property on and adjacent to the work site and shall take suitable, proper, and necessary precautions to protect such property from damage which could result from pile driving operations or associated work. Should damage occur due to Contractor's operations, the Contractor shall bear the responsibility and cost for repairing or replacing the damaged work to its original condition, without additional compensation.

1. Documentation: Photograph existing conditions of structures, finishes, equipment, and adjacent improvements that might be construed as damage resulting from pile driving operations. File photo with Architect before starting pile driving.
2. Locate Existing Utilities: Coordinate the location of all existing underground utilities with the owner. Locate full extent of all existing buried utilities, such as existing sewer lines, existing water lines, existing gas lines, existing power lines, etc, by nondestructive means prior to performing any site work. If the location of any existing utilities, which are to remain, come within 1'-0" of

conflicting with placement of new construction, including piles, the Contractor is to notify the Architect and provide a detailed, dimensioned sketch, prepared by the Contactor, showing the field determined location and elevation of such utilities relative to the building. Such subsurface investigations are be conducted in a timely manner such that the project schedule is not impacted.

C. Provide surveyed elevation bench marks on structures where directed by Architect before commencing work, when structures are adjacent to pile driving operations. Recording and report elevation of each bench mark after driving each pile and at least twice a day while pile driving is in progress. Should bench mark readings indicate displacement, halt driving operations until corrective action has been provided and is acceptable to Architect

PART 2 - PRODUCTS

2.1 TIMBER PILES

A. Round Timber Piles: ASTM D 25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:
   1. Species: Southern yellow pine.
   2. Size Basis: See structural plans.

B. Pressure-treat round timber piles according to AWPA C3 as follows:
   1. Service Condition: Foundation.
   2. Treatment: Oil-borne preservative.
   3. Treatment required: 0.80 CCA Treatment

C. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWPA standard M4.

D. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.

2.2 DRIVING EQUIPMENT

A. General: Provide pile driving equipment of type generally used in standard pile driving practice, operated at manufacturer's specified rate, to development required rated energy per blow.

B. Hammer: Provide pile driving hammers of sufficient capacity, size and type able to deliver consistently effective dynamic energy, suitable to piles to be driven and to subgrade material into which they are to be driven, when operating at not less than 75% efficiency of rated driving energy. Use a Vulcan No. 1 or equivalent hammer to develop 15,000 foot-pounds of energy.

C. Driving Caps: Equip hammer with cast steel or structural steel driving cap, with grooved base conforming to pile shape. Keep bearing surfaces of grooves true and smooth.

D. Pile Cushion (optional): Pile cushion may be used by Contractor if deemed necessary to avoid damage to pile. Submit details of cushion if used.

E. Leads: Use fixed or rigid type pile driver leads that will hold pile firmly in position and alignment, and in axial alignment with hammer. Extend leads to within 2 ft. of elevation at which the pile enters ground.

PART 3 - EXECUTION

3.1 PRE-DRIVING WORK

A. Site Conditions: Do not drive piles until earthwork operation in area which piles are to occupy has been coordinated with General Contractor.
   1. All required fill for building pad shall be placed and compacted prior to driving of piles.

B. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals.

3.2 PROBE PILE

A. General: Probe piles will be used to verify driving criteria and to confirm the presence, depth and extent of the medium dense silty sand layer used for pile end bearing.

B. Provide probe piles at locations indicated on the structural drawings. Contact the Structural Engineer for alternate locations.

C. Drive all probe piles to the refusal criteria noted in these specifications. Drive probe piles in accordance with the criteria from the DRIVING PILES section of this specification and as noted on the probe pile notes in the construction documents.

D. Probe piles may also be used as a static test pile if indicated on the structural drawings.

3.3 STATIC TEST PILE

A. General: Static pile test(s) will be used to confirm allowable design load of piles.
   1. Furnish test pile (or piles) for length indicated on plans.
   2. Determination of actual length of piles will be based on results of static pile test(s) and probe piles. Refer to UNIT PRICES AND PAYMENT section above for more information.

B. Pile Tests: Arrange and perform the following pile test(s):
   1. Axial Compressive Static Load Test: ASTM D 1143-07. Use Procedure A for Quick Test.
   2. Pile shall be loaded to the design load of (21) tons and then unloaded to (0) tons. Pile shall then be reloaded to (63) tons (i.e. three times the design load). Submit a detailed loading scheme to the Structural Engineer and Architect for review prior to commencing the static load test.

C. Equip each test pile with two telltale rods, according to ASTM D 1143, for measuring deformation during load test.

D. The load shall be applied by means of an accurately calibrated hydraulic jack, and load cell acting concentrically with and directly on the head of the pile. All materials required for testing, including the reaction piles (also termed anchor piles), frame, cap plate, etc., with the exception of the hydraulic jack, shall be furnished and installed by the Contractor. The furnishing and installing of the hydraulic jack and the actual load testing will be performed by the independent Testing Agency.
   1. The Contractor will be required to submit to the Architect for approval, detailed plans of the loading apparatus (including the reaction pile, frame, cap plate, etc.). A civil engineer licensed in Louisiana shall provide the design of the loading apparatus. The engineer shall provide stamped drawings and calculations for the loading apparatus. The testing apparatus shall be designed to allow the various increments of load to be placed without causing vibration in the test pile.
      a. Contractor shall coordinate the configuration of the loading apparatus with the Testing Agency to accommodate the hydraulic jack and load cell.
      b. The test load shall be applied by hydraulic jack(s) acting against an anchored reaction frame in a configuration similar to Figure 1of ASTM D 1143.
   2. The loading apparatus (including reaction piles and frame) shall be capable of safely resisting the maximum test load. The reaction piles shall be no closer than five (5) feet to the test pile.
   3. Allow a minimum of fourteen (14) days to elapse after driving test piles before starting pile testing.
   4. Notify Architect at least 48 hours in advance of performing test(s).
   5. Number of Test Piles: As indicated on plans.
   6. On completion of testing, Contractor shall remove testing structure, equipment, and instrumentation. Reaction piles shall be left in place and shall be cut-off 2’-0” below the bottom of the structure directly above the pile or 2’-0” below finish grade if located outside of the limits of the structure.

E. Driving Test Piles: Drive test piles at locations indicated to the refusal criteria indicated herein. Use test piles identical to those required for Project and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.

F. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer. Include same data as required for driving records of permanent piles.

G. Test piles that comply with requirements, including location tolerances, may be used on Project.

3.4 DRIVING PILES

A. General: Continuously drive piles to elevations or penetration resistance indicated.
   1. Establish and maintain axial alignment of leads and piles before and during driving. Take care during driving to prevent and to correct any tendency of piles to twist or rotate

2. Carefully maintain center of gravity for each group or cluster of piles to conform to locations shown on drawings.
3. When handling and driving long pile, take special precautions to ensure against overstress or leading away from a true position when driving. When high-resistant strata lying near the surface must be penetrated, spud piles may be used, when authorized by Architect, to minimize hard driving of long piles during early stages of driving operations.
4. Pile driving may cease when the blow count with a Vulcan No. 1 hammer is ± 25 blows per foot or 20 blows per foot for two consecutive feet, otherwise, drive the pile to within 1' of cut-off elevation (or full length of pile indicated). Contractor is responsible for all costs associated with stopping driving at this blow count refusal i.e., pile cut offs, cap excavations, cut-off disposal, etc

B. Predrilling: Provide pre-excavated holes where indicated to a depth determined during probe pile installation below existing grade. The rig used to drive the job piles shall have pre-drilling capabilities. Pre-drilling should be made by wet rotary methods and should by performed with a fishtail type drill bit that has a maximum diameter of 5.25".
   1. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.

C. Heaved Piles: Provide recorded instrument observations made during pile driving to determine whether driven pile has lifted from its original seat during driving of adjacent piles. If uplift occurs, re-drive affected piles to point elevation at least as deep as original point elevation with a driving resistance at least as great as original driving resistance.

D. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
   1. Location: 3 inches (after pile driving is completed) from location indicated for center of gravity of each single pile or pile group; 2 inch for piles under grade beams.
   2. Plumb: Maintain 1 inch in 10 feet from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.

E. Damaged or mis-driven Piles: Damaged piles, and piles driven outside required driving tolerance will not be accepted.
   1. Immediately remove and replace a pile that is not within the required tolerances, damaged, deflected, broken, or which cannot be driven to proper elevation. Replace such pile with an acceptable substitute pile at the location determined by the Architect. In the event that such pile removal should prove to be impossible, abandon the defective pile and replace it with additional pile(s) driven close to the abandoned one as directed by the Architect.
   2. Drive additional pile or piles where centerline deviation exceeds 3" and redesign indicates load on any pile exceeding 110% of design load.
   3. Solidly fill spaces left by withdrawn piles, that will not be filled by new piles, using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact throughout length of space

F. Defective Pile: Any substantial sudden increase in the rate of penetration of a timber pile shall be investigated for possible damage. If the sudden increase in rate of penetration cannot be correlated to the soil strata, the pile shall be removed for inspection or rejected.

G. Cutting Off: Cut-off tops of driven piles, square with pile axis and at elevations indicated. Dispose of excess materials off site. Owner reserves first rights of refusal to pile cut-offs.

H. Pile-Driving Records: Maintain accurate driving records for each pile.

3.5 VIBRATION MONITORING

A. Pile driving will cause vibrations that may affect nearby buildings and utilities. Pile driving operations shall be continuously monitored at any structure of concern during the driving of all job piles to record their magnitude of vibrations.
   1. Owner shall engage a testing agency to provide continuous vibration monitoring during pile driving operations.
   2. The peak particle velocity of earth between the driving operation and adjacent structures during pile driving shall be 0.25 inch per second or less. If sustained peak particle velocity exceeds 0.25 inch per second, the Contractor shall terminate driving operations.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Pile foundations.

B. Pile Design Load: Design load per pile is 21 tons.

END OF SECTION

SECTION 32 13 13

CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior concrete paving for the following items:

1. Driveways.
2. Parking lots.
3. Concrete curbs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

C. Reinforcing Bars: ASTM A615, Grade 60; deformed.

D. Joint Dowel Bars: ASTM A615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150, Type I or Type II.
2. Fly Ash: ASTM C618, Class F.
   a. Product shall be restricted to suppliers and sources provided on LA DOTD QPL 50.

B. Aggregates: ASTM C33, uniformly graded. Provide aggregates from a single source.
1. Maximum aggregate size: 1 inch nominal.

C. Air-Entraining Admixture: ASTM C260.

D. Chemical Admixtures: ASTM C494. Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

E. Water: Potable and complying with ASTM C94.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Cold-Applied Joint Sealants:
   1. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, non-sag silicone sealant complying with ASTM D5893 for Type NS.
      a. Product shall be restricted to suppliers and sources provided on LA DOTD QPL 42.
   2. Type SL Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D5893 for Type SL.
      a. Product shall be restricted to suppliers and sources provided on LA DOTD QPL 42.

C. Joint-Sealant Backer Materials:
   1. Round Backer Rods for Cold-Applied Sealants: ASTM D5249, Type 3, of diameter and density require to control sealant depths and prevent bottom-side adhesion of sealant.

D. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

   1. Fly Ash or Pozzolan: 20 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

   1. Air Content: 4.5 percent plus or minus 1-1/2 percent.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

   1. Use water-reducing admixture in concrete as required for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

E. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below areas of proposed concrete pavements in accordance with Specification Section 02300 "Earthwork (Site)" to identify soft pockets and areas of excess yielding.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed paving surface with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

   1. Elevation: 1/4 inch.
      a. Maximum variations in surface tolerance shall not exceed 1/4 inch in 10 feet.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Joint Spacing: 3 inches.
   4. Contraction Joint Depth: Plus 1/4 inch, no minus.
   5. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample. One specimen shall be retained for later testing, if required.
6. Compressive-Strength Tests: ASTM C39; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no individual compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: 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 Engineer.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

1. Concrete paving that has been determined to be defective shall be replaced at no additional cost to the Owner.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes painted markings applied to concrete pavement.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, 55 deg F for water-based materials], and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", the ABA standards of the Federal agency having jurisdiction, and ICC A117.1.

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952.

1. Color: As indicated on drawings.

B. Glass Beads: AASHTO M 247, Type 1.

1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 02761

SECTION 33 14 16

SITE WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service mains.

B. All fees assessed by St. John the Baptist Parish for tap, service extension, and meters shall be included in the original contract sum.

1.3 DEFINITIONS

A. PVC: Polyvinyl Chloride

B. DI: Ductile Iron

C. SJTBP: St. John the Baptist Parish

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. 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.

D. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

1.8 COORDINATION

A. Coordinate connection to water main with utility company.
   1. SJTBP will provide tap from existing water main, service extension to project site, and water meters.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 PVC PIPE AND FITTINGS

A. PVC, Schedule 80 Pipe: ASTM D1785 for domestic service piping.
   1. PVC, Schedule 80 Socket Fittings: ASTM D2467.
   2. PVC, Schedule 80 Threaded Fittings: ASTM D2464.

B. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end for fire-service piping.

   1. Comply with UL 1285 for fire-service mains if indicated.

2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.3 JOINING MATERIALS

A. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
1. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
    a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
        1) Standard: AWWA C500.
        2) Minimum Pressure Rating: 200 psig.
        3) End Connections: Flanged.

2. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
    a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
        1) Standard: AWWA C509.
        2) Minimum Pressure Rating: 200 psig.
        3) End Connections: Flanged.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.6 CHECK VALVES

A. AWWA Check Valves:
   1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
      a. Standard: AWWA C508.
      b. Pressure Rating: 175 psig.

2.7 PLUG VALVES

A. Plug Valves:
   1. Description: Resilient-seated eccentric.
      a. Standard: MSS SP-108.
      b. Body: Cast iron.
      c. Pressure Rating: 175-psig minimum CWP.
      d. Seat Material: Suitable for potable-water service.

2.8 WATER METERS

A. Water meters will be furnished by SJTBP Utilities Department.

2.9 BACKFLOW PREVENTERS

A. Backflow preventer shall be located immediately downstream of water meter and shall have thermal protection as listed in this section.

B. Reduced-Pressure-Principle Backflow Preventers:

   1. Standard: ASSE 1013 or AWWA C511.
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: Coordinate with plumbing engineer for requirements.
   4. Size: Shall match service main diameter indicated on Drawings.
   5. Design Flow Rate: Coordinate with plumbing engineer for requirements.
   6. Pressure Loss at Design Flow Rate: Coordinate with plumbing engineer for requirements.
   7. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved, steel with interior lining complying with AWWA C550 or that is FDA approved, or stainless steel for NPS 2-1/2 and larger.
   8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   9. Configuration: Designed for vertical inlet, horizontal center section, and vertical outlet flow.
   10. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

2.10 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:
1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as 0 deg F.

a. Standard: ASSE 1060.
b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.

B. Enclosure Bases:

1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 20 00 "Earthwork (Site)" for excavating, trenching, and backfilling.

3.2 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal-seated gate valves with valve box.
2. Use the following for valves in vaults and aboveground:
a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, rising stem.

b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
c. Check Valves: AWWA C508, swing type.

3. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
4. Relief Valves: Use for water-service piping in vaults and aboveground.
   a. Air-Release Valves: To release accumulated air.
   b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
   c. Combination Air Valves: To release or admit air.

3.3 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

C. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration.

D. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

E. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.4 JOINT CONSTRUCTION

A. Make pipe joints according to the following:
   1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
   2. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
      a. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
      b. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

3.5 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves. Install full-size valved bypass.

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.7 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

3.8 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.9 CONNECTIONS

A. Connect water-distribution piping to utility water main extension.

B. Connect water-distribution piping to interior domestic water piping.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
   1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Backflow preventers shall be tested in accordance with International Plumbing Code Section 312.10 and all referenced standards.

D. Prepare reports of testing activities.

3.11 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 02300 "Earthwork (Site)."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

3.12 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
   3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 14 16

SECTION 33 31 13

SITE SANITARY SEWER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. PVC pipe and fittings.
   2. Expansion joints and deflection fittings.
   3. Cleanouts.
   4. Manholes.

1.3 SUBMITTALS

A. Product Data: For the following:

   1. Pipe and fittings.
   2. Non-pressure couplings
   3. Expansion joints and deflection fittings.
   4. Cleanouts.
   5. Manholes.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

C. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.5 FIELD CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:12454

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

1. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig minimum working pressure and for expansion indicated..

C. Ductile-Iron Deflection Fittings:

1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Medium Duty and Extra-Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.4 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02300 "Earthwork (Site)".

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install cleanouts at changes in direction. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Unshielded flexible couplings for pipes of same or slightly different OD.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
   2. Use pressure pipe couplings for force-main joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Medium-Duty, top-loading classification cleanouts in unpaved areas.
   2. Use Extra-Heavy-Duty, top-loading classification cleanouts in all paved areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.6 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in plumbing specifications.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Test plastic gravity sewer piping according to ASTM F 1417.

7. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 33 31 13

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SECTION 33 42 00

SITE STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. All references to LADOTD specifications are to the Louisiana Standard Specifications for Roads and Bridges, 2016 Edition.

1.2 SUMMARY

A. Section Includes:
   1. Pipe and fittings.
   2. Cleanouts.
   3. Manholes.
   4. Stormwater inlets.

1.3 SUBMITTALS

A. Product Data: For drainage structures, pipes, and fittings.

B. Shop Drawings:

   1. All drainage structures shall be identified by the designations provided on the construction drawings.
   2. Manholes: Include plans, top and invert elevations, pipe elevations, sections, details, reinforcement, frames, and covers.
   3. Stormwater inlets: Include plans, top and invert elevations, pipe elevations, sections, details, reinforcement, frames, and grates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes in accordance with manufacturer's written rigging instructions.

D. Handle stormwater inlets in accordance with manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 949, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Medium and Extra-Heavy Duty
3. Pipe Fitting and Riser to Cleanout: PVC Schedule 80 or SDR 35 plastic pipe and fittings.

2.3 PRE-CAST CONCRETE DRAINAGE STRUCTURES

A. Provide structures in accordance with plans, conforming to dimensions, reinforcement, and appurtenances as indicated.

B. Standard Precast Concrete Drainage Structures:

1. Description: ASTM C 913, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into structure walls, for each pipe connection.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch inside diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

D. Stormwater Inlet Frames and Grates: Include flat grate with short-slotted drainage openings.

1. Size: 12 by 12 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
3. Material: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading.

2.4 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:

1. Cement: ASTM C 150/C 150M, Type II.
2. Fine Aggregate: ASTM C 33/C 33M, sand.
3. Coarse Aggregate: ASTM C 33/C 33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 1064/A 1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.5 POLYMER STORMWATER INLETS

A. Provide structures in accordance with plans, conforming to dimensions, materials, and appurtenances as indicated.

B. Polymer Drainage Structures:

1. Description: ASTM D1784, Polyvinyl Chloride, of depth indicated, with provision for sealant joints.
2. Joint Sealant: ASTM F477

3. Pipe Connections: ASTM D3212, fitted into connection stubs provided on basin channel.
4. Bedding Material: ASTM D2321, placed to dimensions required by manufacturer and uniformly compacted.

C. Frames and Grates: Provide circular, atrium type frame and grate fitted onto circular basin channel.

1. Size: 12 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
3. Material: ASTM A536, Grade 70-50-05, ductile iron designed for A-16 (AASHTO HS20-44), structural loading.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 02300 "Earthwork (Site)".

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Stormwater runoff shall not be directed towards or allowed to shed into open pipe trenches.

G. Adequate ground cover, as determined by manufacturer, shall be provided over installed pipe to prevent flotation. If adequate depth cannot be achieved, anchor system per manufacturer's recommendation shall be provided at no additional cost to Owner.

H. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install PVC sewer piping in accordance with ASTM D 2321 and ASTM F 1668.
3. Install reinforced-concrete sewer piping in accordance with ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:

1. Join PVC corrugated sewer piping in accordance with ASTM D 2321 for elastomeric-seal joints.
2. Join PVC sewer piping in accordance with ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
3. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use plastic pipe fittings in sewer pipes at branches for cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Medium Duty top-loading classification cleanouts in areas of grass, landscaping, or that will be subject to foot traffic only.
2. Use Extra-Heavy Duty top-loading classification cleanouts in areas of proposed vehicular use.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAINAGE STRUCTURE INSTALLATION

A. General: Install manholes and inlets, complete with appurtenances and accessories indicated.

B. Install precast drainage structure sections with sealants in accordance with ASTM C 891.

C. Where specific drainage structure construction is not indicated, follow manhole manufacturer's written instructions.

D. Precast Concrete Manholes:

1. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

E. Precast Concrete Inlets:

1. Construct catch basins to sizes and shapes indicated.
2. Set frames and grates to elevations indicated.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping in accordance with ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

E. Maintain stormwater pollution prevention measures at each drainage structure and conveyance system throughout project duration. Clean interior of piping and drainage structures of dirt and superfluous materials (do not flush into outfall system).

END OF SECTION 33 42 00

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