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Project Manual for
Independence School District
Central Warehouse

14001 East 32nd Street
Independence, MO 64055

Prepared For:
Independence School District
201 N. Forest Avenue
Independence, Missouri 64050

Project Number: 15078

February 2016

Set No:_____

DOCUMENT 000101 – PROJECT TEAM DIRECTORY

PROJECT:	Independence School District – Central Warehouse 14001 East 32nd Street Independence, Missouri 64055
OWNER:	Independence School District 201 North Forest Avenue Independence, Missouri 64050 Contact: Robert Burkey, Director of Facilities Phone: 816.521.5300
ARCHITECT:	Hollis + Miller Architects, Inc. 220 NW Executive Way Lee's Summit, Missouri 64063 Contact: Grant Thome Phone: 816.525.5600 / Fax: 816.525.3028 Email: gthome@hollisandmiller.com
CIVIL ENGINEER:	Crowley, Wade, Milstead, Inc. 3200 South State Route 291, Bldg 1 Independence, Missouri 64507 Contact: Aaron Barnhart Phone: 816.373.4800 Email: amb@cwm-inc.com
STRUCTURAL ENGINEER:	Hollis + Miller Architects, Inc. 220 NW Executive Way Lee's Summit, MO 64063 Contact: John Funk Phone: 816.525.5600 / Fax: 816.525.3028 Email: jfunk@hollisandmiller.com
MEP ENGINEER:	Olsson Associates 1251 NW Briarcliff Parkway, Suite 50 Kansas City, Missouri 64116 Contact: Nick Lynch Phone: 816.361.1177 Email: nlynch@olssonassociates.com

END OF DOCUMENT 000101

DOCUMENT 000105 – CERTIFICATIONS AND SEALS

Architect:

I hereby state, pursuant to RSMo 327.411, that the Specifications intended to be authenticated by my seal are limited to Specification Sections listed below:

Division 1 Sections:	011000, 012100, 012200, 012300, 012500, 013300, 014200 and 016000.
Division 2	
Division 5 Sections:	055000 and 055213.
Division 6 Section:	064023
Division 7	
Division 8	
Division 9	
Division 10	
Division 11	
Division 12	
Division 31 Sections:	313116 and 313200
Division 32 Section:	321723
Division 33 Section:	334600.

I hereby disclaim any responsibility for all other specifications, drawings estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the architectural or engineering project or survey.

KIRK C. HORNER
Architect

STATE OF MISSOURI
KIRK CHRISTIAN HORNER
NUMBER A-2001016578
ARCHITECT

JUNE 16, 2016
Date

Structural Engineer:

I hereby state, pursuant to RSMo 327.411, that the Specifications intended to be authenticated by my seal are limited to Specification Sections listed below:

Division 3	
Division 4	
Division 5 Section:	053100
Division 6 Section:	061000

I hereby disclaim any responsibility for all other specifications, drawings estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the architectural or engineering project or survey.

Structural Engineer

STATE OF MISSOURI
JOHN E. FUNK
NUMBER E-2000173299
REGISTERED PROFESSIONAL ENGINEER

6/16/16
Date

MECHANICAL ENGINEER'S CERTIFICATION

I state, pursuant to RSMo 327.411, that the Specifications intended to be authenticated by my seal are limited to Specification Sections listed below:

Division 21
Division 22
Division 23

I hereby disclaim any responsibility for all other specifications, drawings estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the architectural or engineering project or survey.

June 16, 2016

Mechanical Engineer | Date

ELECTRICAL ENGINEER'S CERTIFICATION

I state, pursuant to RSMo 327.411, that the Specifications intended to be authenticated by my seal are limited to Specification Sections listed below:

Division 26
Division 27
Division 28

I hereby disclaim any responsibility for all other specifications, drawings estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the architectural or engineering project or survey.

June 16, 2016

Electrical Engineer — Date

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Independence School District - Central Warehouse
14001 East 32nd Street
Independence, MO 64055

Project No. 15078

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DOCUMENT 001100 – INFORMATION FOR BIDDERS

BIDS will be received by the Board of Education, School District of Independence, Missouri (herein called the "OWNER"), at Ennovation Center, ISD Facilities Department, 201 North Forest Avenue, Independence, Missouri 64050 until **2:00 p.m.,** local time, on **July 26, 2016**, and then at said office publicly opened and read aloud.

Bids must be submitted in a sealed envelope, addressed to the Board of Education, School District of Independence, Missouri, 201 North Forest Avenue, Independence, Missouri 64050. Each sealed envelope containing a bid(s) must be plainly marked on the outside as a bid for the **INDEPENDENCE SCHOOL DISTIRICT – CENTRAL WAREHOUSE**, and the envelope should bear on the outside the bidder's name and address. If forwarded by mail, the sealed envelope containing the bid(s) must be enclosed in another envelope addressed to the Board of Education, School District of Independence, Missouri, 201 North Forest Avenue, Independence, Missouri 64050.

There will be a **Pre-Bid Conference on June 28, 2016 at 2:00 p.m., local time**, at Ennovation Center, ISD Facilities Department, 201 North Forest Avenue, Independence, Missouri. All interested parties are strongly encouraged to attend this Pre-Bid Conference.

This project may be awarded under a single contract with one General Contractor. Bids must be made on the required bid form. All blank spaces for bid prices must be filled in, in ink or typewritten, and the bid form must be fully completed and executed when submitted. A conditional or qualified bid will not be accepted.

This project is tax exempt. Bidders are to exclude sales tax from their bids. The Owner will provide documentation evidencing the same to the successful bidder(s).

The Owner may waive any informalities or minor defects or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within ninety (90) days after the actual date of the opening thereof. Should there be reasons why the contracts cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the bidder.

Bidders must satisfy themselves of the accuracy of the drawings and specifications including addenda. After bids have been submitted, the bidder shall not assert that there was a misunderstanding concerning the quantities of work or of the nature of the work to be done.

The Contract Documents contain the provisions required for the construction of the projects. Information obtained from an officer, agent or employee of the Owner or any other person shall not affect the risks or obligations assumed by the Contractor or relieve the Contractor from fulfilling any of the conditions of the contract.

The bid must be accompanied by a Bid Bond payable to the Owner for five percent (5%) of the total amount of the bid. As soon as the bid prices have been reviewed and the apparent successful Bidders have been identified, the Owner will return the Bonds of all unsuccessful bidders. The Bid Bonds of the successful bidders will be retained until the Performance Bond and Labor and Material Payment Bond have been executed and approved, after which it will be returned. A certified check may be used, in lieu of a Bid Bond.

A Performance Bond and Labor and Material Payment Bond in the amount of 100 percent of the contract price, with a corporate surety approved by the Owner, will be required for the faithful performance of the contract.

Attorneys-in-fact who sign Bid Bond or Performance Bond and Labor and Material Payment Bond must file with the bond a certified and effective dated copy of their power of attorney.

The parties to whom the contracts are awarded will be required to execute the agreement and obtain the Performance Bond and Labor and Material Payment Bond within ten (10) calendar days from the date when Notice of Award is delivered to the bidder. The Notice of Award shall be accompanied by the necessary agreement and bond forms. In case of failure of any bidder to execute the agreement, the Owner may consider the bidder in default, in which case the bid bond accompanying the proposal shall become the property of the Owner. Upon default by any of the successful bidders, the award may then be made to another responsible bidder, or the work may be readvertised for a construction contract or otherwise, as the Owner may decide.

The Owner, upon receipt of an acceptable Performance Bond and Labor and Material Payment Bond, Certificate of Insurance, and agreement signed by the party to whom the agreement was awarded, shall, within a reasonable period of time, sign the agreement and return to such party an executed duplicate of the agreement. The Owner upon signing the agreement will immediately issue the Notice to Proceed.

The Owner may make such investigations as deemed necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the agreement and to complete the work contemplated therein.

All applicable laws, ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout.

Each bidder is responsible for inspecting the sites and for reading and being thoroughly familiar with the contract documents. The failure or omission of any bidder to do any of the foregoing shall in no way relieve any bidder from any obligation in respect to its bid.

When manufacturers' names are used to establish a standard and the words "or equal", if not stated, are implied.

The successful bidders shall supply the names and addresses of major material suppliers and subcontractors when required to do so by the Owner. Pre-bid approval is required on major equipment and material.

The Architect is Hollis and Miller Architects. The Architect's address is 220 NW Executive Way, Lee's Summit, Missouri 64063.1841. Oral questions should be directed to Justin Durham at 816.525-5600, Fax 816.525-3028, email jdurham@hollisandmiller.com.

Bonds shall be executed with the proper sureties, through a company licensed to operate in the State of Missouri, and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in Circular 570 by the Audit Staff Bureau of Accounts, U.S. Treasury Department.

Each bidder must submit as part of his bid proposal, a list of subcontractors to be used in performing the work. The list shall specify the single designated subcontractor's name and address for each category of work listed in the Bid Form. If work within a category will be performed by more than one subcontractor, list the name and address of each subcontractor and specify the exact portion of the work to be done.

This work will be governed by the Prevailing Wage Law. Refer to Document 008100 "Prevailing Wage Determination" for requirements.

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END OF INFORMATION FOR BIDDERS

DOCUMENT 002100 – INSTRUCTIONS TO BIDDERS

A. A copy of the American Institute of Architects Document A701, Instructions to Bidders 1997 Edition, is bound hereinafter as amended by Document 002200 – Supplementary Instruction to Bidders. This Document is included for information only and may not be duplicated.

B. Additional copies of the Instructions to Bidders may be obtained, at cost, from the Kansas City Chapter, of the American Institute of Architects, at the address listed below:

AIA Kansas City
1801 McGee, Suite 100
Kansas City, Missouri 64108
Telephone: (816) 221-3485.
www.aiakc.org

END OF DOCUMENT 002100

AIA® Document A701™ – 1997

Instructions to Bidders

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

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

TABLE OF ARTICLES

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.

§ 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 BIODING 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 ten 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 ADOENOA

§ 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.

§ 3.4.3 Addenda will be issued no later than four days 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 PROCEOURES

§ 4.1 PREPARATION OF BIOS

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

§ 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.

§ 4.2 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.

§ 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, if applicable, the designated portion of the Work 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, facsimile or other electronically transmitted 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.

§ 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.

§ 5.3 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 which, in the Owner's judgment, is in the Owner's own best interests.

§ 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 BONO ANO PAYMENT BONO

§ 7.1 BONO 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.

§ 7.2 TIME OF OELIVERY ANO FORM OF BONOS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following 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.

DOCUMENT 002200 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

REFER TO AMERICAN INSTITUTE OF ARCHITECTS INSTRUCTIONS TO BIDDERS – A701

The following supplements apply to the above referenced AIA Documents A701, "Instructions to Bidders", current edition. The Article number used herein refer to the same Article numbers in that Document. Modification of these Articles, whether wholly or partially changed herein, takes precedence over any statement contained in AIA Document A701.

1. ARTICLE 1 – DEFINITIONS – No Revisions

2. ARTICLE 2 – BIDDER'S REPRESENTATIONS

   A. Section 2.1.5. *Add the following*: "The Bidder will not later request and will not later expect to receive additional payment for work related to conditions which can be determined by examination of the site and the Bidding Documents."

3. ARTICLE 3 – BIDDING DOCUMENTS

   B. Section 3.3.1. *Add the following*: "Substitutions will be allowed only by procedures specified, refer to Section 010000 "Division 1 Requirements". Materials, products, equipment and systems proposed by substitution are subject to approval of the Architect, his judgment and decision will be final. Submission of Bidder's Bid shall be taken as prima facie evidence of Bidder's compliance with these instructions."

   C. Section 3.3.2. *Replace Subparagraph 3.3.2 with the following*: "Bidders proposing substitutions for materials, products, equipment or systems other than those specified in the proposed contract Documents under the 'or equal' provisions shall submit request for substitution in writing to the Architect. Submittals for proposed substitutions shall be received by the Architect's office not later than 4:00 p.m., eight (8) calendar days prior to the date established for the Receipt of Bids. Each request shall include the name of the material, product, equipment, or system for which it is to be substituted and all basic data and characteristics of the proposed item, so that a direct comparison can be readily made. It is the sole responsibility of the Proposer to submit complete descriptive and technical information necessary for Architect's evaluation. The burden of proof of the merit of proposed substitution is upon the Proposer."

   D. Section 3.3.2.1.*Add the following*: "Requests for substitution shall include the completed 'Substitution Request Form' located at the end of Section 010000. The substitution request form shall be incorporated as the first page of each submittal. Failure to submit this form will lead to disapproval of the proposed substitution."

   E. Section 3.3.5. *Add the following*: "Whenever substitutions alter the design or space requirements indicated on the plans, the Contractor shall include all items of cost of the revised design and construction, including costs of all allied trades involved."

4. ARTICLE 4 – BIDDING PROCEDURES

   A. Section 4.1.1.1.*Add the following*: "Proposal Form: The Proposal Form is included in the Project manual for Bidder's duplication and use, refer to Document 004200. Bidders shall submit one (1) copy of a fully executed Proposal Form with his/her bid."

   B. Section 4.1.8.*Add the following*: "If so stipulated in the Advertisement or Invitation to Bid, each Bid shall be accompanied by a completed Contractor's Qualification Statement (AIA Document A305)"

   C. Section 4.2.1.1.*Add the following*: "Bid Security: Each Bid is to be accompanied by a Bid Bond in the amount of five percent (5%) of the Bid submitted, made payable to the Owner, as listed in the Invitation to Bid."

   D. Section 4.2.2.*Delete Subparagraph 4.2.2 and replace with the following*: "If the Bidder elects to provide a Bid Bond on AIA Document A310, it must also include a certified and current copy of the Power of Attorney by the Attorney in Fact who executes the Bond on behalf of the Surety."

   E. Section 4.2.3.1.*Add the following*: "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."

   F. Section 4.3.1.1.*Add the following*: "Additional Forms and Affidavits to accompany Bids: Each Bid is to be accompanied by: E-Verify certification, OSHA Training affidavit and Drug Free Workplace certification letter."

G. Section 4.3.2.1.*Add the following*: "Bidders shall be responsible for actual delivery of Bid and it is not sufficient to show that it was mailed in time to be received before the scheduled closing time for receipt of Bids."

H. Section 4.3.5.*Add the following*: "The proposal form, as shown in these Contract Documents, must be followed by each Bidder. Bid shall state the total lump sum price to do all Work described in the Bidding Documents under a single Contract. Dollar amounts shall be stated in both words and numbers, and in the case of a discrepancy between the two, the amount written in words shall govern."

I. Section 4.3.6.*Add the following*: "The Owner reserves the right to waive irregularities in the Bids and reject any and all Bids."

J. Section 4.4.1.*Delete the first sentence of Subparagraph 4.4.1 and substitute the following*: "Any Bidder may withdraw his Bid at any time prior to the scheduled closing time for the receipt of Bids, but no Bid shall be withdrawn, modified, or canceled for a period of sixty (60) days following the time and date finally designated for the receipt of Bids."

5. ARTICLE 5 – CONSIDERATION OF BIDS

A. Section 5.1.1.*Delete the first sentence of Subparagraph 5.1.1 and substitute the following*: "Properly identified Bids received on time will be opened publicly and read aloud."

B. Section 5.2.1.*Add the following*: "The Owner reserves the right to reject any and/or all Bids and further to waive all informalities in bidding when deemed in the best interest of the Owner."

C. Section 5.3.3.*Add the following*: "In awarding the Contract, the Owner may take into consideration the Contractor's skill, facilities, capacity, experience, responsibility, previous work record, and financial standing in the necessity of prompt efficient completion of the Work herein described. Inability of any Contractor to meet the requirements mentioned above may be cause for rejection of this proposal. The Owner reserves the right to let other Contracts in connection with the Work at the Project Site."

D. Section 5.3.4.*Add the following*: "The Owner, together with the Architect, may interview the apparent low Bidders before Contracts are awarded. The interview will enable the Owner and/or Architect to ask the Contractor questions about materials, labor, duration, scope of the work, or any other information necessary to evaluate those considerations enumerated in Paragraph 5.3.3 above."

E. Section 5.3.5.*Add the following*: "The Owner shall have the right to accept alternates in any order or combination unless otherwise specifically provided for in the Bidding Documents, and to determine the low Bidder on the basis of sum of the Base Bid and the Alternates accepted."

F. Section 5.3.6.*Add the following*: "Bidder to whom award of Contract is made shall execute an agreement with the Owner. Contractor's mobilization or commencement of his Work, without having a signed Contract, will be construed as his acceptance of the Conditions and Terms of his Contract with the Owner."

6. ARTICLE 6 – POST-BID INFORMATION – No Revisions

7. ARTICLE 7 – PERFORMANCE BOND AND PAYMENT BOND

A. Section 7.1.1.1.*Add the following*: "Bond Requirements: The Bidder shall include in his Bid the cost of a Performance Bond and Payment Bond (AIA Document A312) and such other Bonds as may be required under "MISCELLANEOUS PROVISIONS" in the Supplementary Conditions, found elsewhere in the Contract Documents."

B. Section 7.1.3.*Add the following*: "Bonds (Bid, Payment, Performance, and Public Works) must be written by a surety Company that is listed in the latest edition of the Federal register as holding a certificate of authority and an underwriting limit large enough for the Project. The Surety must also be licensed to do business in the state of Missouri."

8. ARTICLE 8 – FORM OF AGREEMENT:

A. *Revise to read as follows*: "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, as modified by Owner."

9. ARTICLE 9 – MISCELLANEOUS PROVISIONS: Add New Article 9 in its entirety with the following:

A. Article 9.1 MISCELLANEOUS PROVISIONS

B. Section 9.1.1.*Add the following*: "The Owner desires to avoid payment of sales tax on supplies, material and equipment incorporated in this project. Accordingly, all Bids shall be made without sales and use tax. The School District will provide each Contractor with the sales tax exemption number for this Project."

C. Section 9.1.2.*Add the following*: "Upon completion of the Project, each contractor will be required to complete the following forms as listed below:

- Asbestos-free Letter
- Consent of Surety
- Contractors Affidavit
- Certificate of Substantial Completion (forms to be furnished to Contractor at Substantial Completion)
- Written warranty / guaranty
- Operation and Maintenance Manuals
- Final Lien Waiver

All closeout documents must be submitted to the Architect within thirty (30) days of established Substantial Completion date.

END OF SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

DOCUMENT 004200 - BID PROPOSAL

Proposal of _____ (hereinafter called "Bidder"), organized and existing under the laws of the State of _____, doing business as a corporation, a partnership , an individual *(circle one)* to the **Board of Education, School District of Independence, Missouri** (hereinafter called "Owner").

1. In compliance with your Advertisement for Bids, Bidder hereby proposes to perform all work for the **INDEPENDENCE SCHOOL DISTRICT – CENTRAL WAREHOUSE** in strict accordance with the Contract Documents, within the time set forth herein and at the prices stated below. Bidder should propose on individual base bids for specific project locations as noted below. Owner will award contract per individual base bid.

2. The Bidder hereby understands that time is of the essence on this project and is aware of the following critical completion dates:

	SUBSTANTIAL COMPLETION	FINAL COMPLETION
CENTRAL WAREHOUSE	2 DECEMBER 2016	16 DECEMBER 2016

3. The Bidder hereby understands that Liquidated Damages for the delay in completions (Refer to Section 007400, SPECIAL CONDITIONS, Item No. 13) shall be **$500.00** per calendar day.

4. By submission of this Bid, each Bidder certifies, and in the case of a joint Bid each party thereto certifies as to its own organization, that this Bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid with any other Bidder or with any competitor.

5. Bidder acknowledges receipt of the following ADDENDA: _____.

6. The undersigned, having familiarized itself with local conditions affecting the cost of the work at the place where the work is to be done and with all Bidding Documents, including the Instructions to Bidders, Plans and Specifications, General and Supplementary Conditions, the Standard Form of Agreement and the other Contract Documents, and having examined the location of the proposed work and considered the availability of labor and materials, hereby proposes and agrees to perform everything required to be performed, and to provide and furnish any and all labor, materials, supervision, necessary tools, equipment, and all utility and transportation service necessary to perform and complete in a workmanlike and timely manner all of the work required for the project, all in strict conformance with the Instructions to Bidders and other Contract Documents (including Addenda noted above, the receipt of which is hereby acknowledged), for the lump sums hereinafter specified.

7. **BASE BID:**
Bidder agrees to perform all the work described in the Contract Documents for **INDEPENDENCE SCHOOL DISTRICT – CENTRAL WAREHOUSE** for the lump sum total of:

_____Dollars and _____cents.

$_____.

8. **ALTERNATE NUMBER ONE:**
Bidder agrees to perform all the work described in the Contract Documents for **Alternate No. 1 (Omit Painting – Selected Areas)** for **INDEPENDENCE SCHOOL DISTRICT – CENTRAL WAREHOUSE** for the lump sum total of:

_____Dollars and _____cents.

$_____.

9. **ALTERNATE NUMBER TWO:**
Bidder agrees to perform all the work described in the Contract Documents for **Alternate No. 2 (Paint Building Exterior)** for **INDEPENDENCE SCHOOL DISTRICT – CENTRAL WAREHOUSE** for the lump sum total of:

_____Dollars and _____cents.

$_____.

10. Contractor mark-up for overhead and profit for changes (extras or credits) in the work: 10%.

11. The bidder hereby certifies that the following subcontractors will be used in the performance of the work on each or both projects. **ALL General Contractors MUST furnish a copy of their proposed Sub-Contractor List by 4:00 PM CDT on bid day to be considered as valid. If not submitted at the time of Bidding, the list may be delivered, emailed (jdurham@hollisandmiller.com) to the A/E offices, but must be received by no later than the time listed above.**

RESPECTFULLY SUBMITTED:

_____	_____
Signature	Title
_____	_____
Name (Please type or write clearly)	Date
_____	_____ _____
Company Name	Telephone Number Fax Number
_____	_____
Street	Email address
_____	_____
City, State, Zip Code License number (if applicable)	

SEAL - (if BID is by a corporation)

SUB-CONTRACTOR LIST
(If None, So State)

Name and Address of Subcontractor	Work to be Performed

Attach Separate Sheet if necessary

END OF BID PROPOSAL

DOCUMENT 004313 - BID SECURITY FORMS

1.1 PROPOSAL FORM SUPPLEMENT

A. A completed bid bond form is required to be attached to the Proposal Form.

1.2 BID BOND FORM

A. The Form of the bid security shall be American Institute of Architects (AIA), Document A310 – 2010 "Bid Bond". A copy of the Bid Bond form is bound hereinafter for information only and may not be duplicated.

B. Additional copies of the Bid Bond may be obtained, at cost, from the Kansas City Chapter, of the American Institute of Architects, at the address listed below:

AIA Kansas City
1801 McGee, Suite 100
Kansas City, Missouri 64108
Telephone: (816) 221-3485.
www.aiakc.org

END OF DOCUMENT 004313

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed delcted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

DOCUMENT 004513 - STATEMENT OF GENERAL CONTRACTORS' OR SUBCONTRACTORS' QUALIFICATIONS

Each General Contractor bidding the work included in the specifications and Drawings shall submit the data requested in the following schedule of information. This form must be completed and submitted to the Owner in a sealed envelope. Failure to comply with this instruction may be regarded as justification for rejecting the Contractor's Proposal. Refer also to Section 007400 "Special Conditions" for additional requirements.

1. Name of Bidder _____

2. Business address _____

3. When organized _____

4. When incorporated _____

   State of incorporation _____

   President's name _____

   Vice-President's name _____

   Secy's or Clerk's name _____

5. If individual or partnership

   Date of organization _____

   Name and address of all partners _____

   _____

   _____

6. Number of years engaged in contracting business under present firm name

   _____

7. Experience in the construction of work generally similar to this project including list of structures, location, the approximate cost thereof, (Attach additional sheets, if necessary, giving information in detail.)

8. Have you ever failed to complete any work awarded to your present company or any former companies? If so, where and why _____
   _____
   _____

9. Have you ever defaulted on a contract? _____
   If so, where and why _____
   _____
   _____

10. Contracts now on hand indicate gross amount of $ _____ .

11. Include herein (attached), a current financial statement.

Signed_____ Date _____
Contractor

DOCUMENT 005200 – AGREEMENT FORM

1.1 OWNER AND CONTRACTOR AGREEMENT

A. The form of the agreement shall be American Institute of Architects (AIA) Document A101 – 2007, "Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum". The "agreement" is included by reference.

B. A copy of AIA Document A101 – 2007 may be obtained, at cost, from the Kansas City Chapter, of the American Institute of Architects, at the address listed below:

AIA Kansas City
1801 McGee, Suite 100
Kansas City, Missouri 64108
Telephone: (816) 221-3485.
www.aiakc.org

END OF DOCUMENT 005200

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
(In words, indicate day, month and year.)

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

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.

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

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

1

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

The Owner and Contractor agree as follows.

Init.

TABLE OF ARTICLES

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 OATE OF COMMENCEMENT ANO 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 ( ) 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.)

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.)

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 ($0.00)

§ 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:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than ( ) 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 percent (%). 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 percent (%);

.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.)

§ 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.

§ 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:

ARTICLE 8 DISPUTE RESOLUTION

§ 8.1 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 RESDLUTIDN

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.)

[ ] 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 MISCELLANEDUS PRDVISIONS

§ 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.)

%

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

§ 8.4 The Contractor's representative:
(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.)

Section	Title	Date	Pages

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

Number	Title	Date

§ 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 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)**

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)*

DOCUMENT 006113 – PERFORMANCE BOND AND PAYMENT BOND

1.1 PERFORMANCE BOND AND PAYMENT BOND

A. The forms for the bonds shall be American Institute of Architects (AIA) Document A312 - 2010, "Performance Bond and Payment Bond". A copy of each of the bonds is bound hereinafter for information only and may not be duplicated.

B. Additional copies of the performance bond and payment bond may be obtained, at cost, from the Kansas City Chapter, of the American Institute of Architects, at the address listed below:

AIA Kansas City
1801 McGee, Suite 100
Kansas City, Missouri 64108
Telephone: (816) 221-3485.
www.aiakc.org

END OF DOCUMENT 006113

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**	**OWNER'S REPRESENTATIVE:** *(Architect, Engineer or other party:)*

Init.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 18.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

DOCUMENT 006273 – APPLICATION AND CERTIFICATE FOR PAYMENT

1.1 APPLICATION AND CERTIFICATE FOR PAYMENT

A. The Form of the Application and Certificate for Payment shall be AIA Document G702 – 1992 "Application and Certification for Payment" and G703 – 1992 "Continuation Sheet. A copy of each form is bound hereinafter for information only and may not be duplicated.

B. Additional copies AIA Document G702 and AIA Document G703 may be obtained, at cost, from the Kansas City Chapter, of the American Institute of Architects, at the address listed below:

AIA Kansas City
1801 McGee, Suite 100
Kansas City, Missouri 64108
Telephone: (816) 221-3485.
www.aiakc.org

END OF DOCUMENT 006273

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:** 1	**APPLICATION NO:** 002	**Distribution to:**
		PERIOD TO:	OWNER:
		CONTRACT FOR: General Construction	ARCHITECT:
FROM CONTRACTOR:	**VIA ARCHITECT:** Hollis + Miller Architects 220 NW Executive Way Lee's Summit, Missouri 64063	**CONTRACT DATE:**	CONTRACTOR:
		PROJECT NOS: / /	FIELD:
			OTHER:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM	$	0.00
2. NET CHANGE BY CHANGE ORDERS	$	0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	$	0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	$	0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$	0.00
b. 0 % of Stored Material (Column F on G703)	$	0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	$	0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)	$	0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)	$	0.00
8. CURRENT PAYMENT DUE	$	0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$	0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$ 0.00	$ 0.00
Total approved this Month	$ 0.00	$ 0.00
TOTALS	$ 0.00	$ 0.00
NET CHANGES by Change Order	$ 0.00	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

AIA Document G703™ – 1992

Continuation Sheet

AIA Document, G702™–1992, Application and Certification for Payment, or G736™–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PRDJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
	GRAND TOTAL	$0.00	$0.00	$0.00	$0.00	$0.00	0.00 %	$0.00	$0.00

User Notes:

(1366841160)

DOCUMENT 006275 – PARTIAL LIEN WAIVERS

1.1 PARTIAL LIEN WAIVER

A. The Form of the Partial Lien Waiver is bound hereinafter for Contractor's use and duplication.

END OF DOCUMENT 006275

PARTIAL LIEN WAIVER

Reference that certain Agreement between _____, as Contractor, and Independence School District of Independence, Missouri in Jackson County as Owner, dated on the Project know as: Independence School District – Central Warehouse, Project No. 15078, for work to be performed by said Contractor.

Reference also that certain Invoice (s) No(s). _____ of Contractor to said Owner in the amount of $_____ for work, labor, and materials installed in or furnished for said Project as of _____ _____, 20____.

Upon receipt of the Owner's remittance for the amount of said invoice(s) and contingent upon the final clearance and payment of said remittance, Contractor agrees to and does hereby waive and release said property, Project and Owner from any and all liens, statutory or otherwise, for any and all work, labor and materials furnished by or through _____ Contractor on said Project to and including the work, labor, and materials covered by said above numbered invoice(s) except for unpaid retainage.

The remittance of the Owner's identified as payment of said above numbered invoice(s) as endorsed by Contractor marked "paid" or otherwise canceled by the bank against which said remittance was drawn shall constitute conclusive proof that said Invoice(s) were paid and that payment thereof was received by Contractor and this lien waiver shall become effective automatically and without requirement of any further act, acknowledgement or receipt on the part of the Contractor named herein.

Dated this _____ Day of _____, 20____.

_____
By

_____
Title

Notary Seal (Below)

_____
Notary Public

Subscribed and sworn to before me within and for

STATE OF _____

COUNTY OF _____

On this _____ Day of _____, 20_____

My Commission Expires: _____

DOCUMENT 006276 – BAILMENT RECIEPT

1.1 BAILMENT RECIEPT

A. The Form of the Bailment Receipt is bound hereinafter for Contractor's use and duplication.

END OF DOCUMENT 006276

NON-NEGOTIABLE BAILMENT RECEIPT

Receipt No._____

BAILOR: Board of Education
Independence School District
201 North Forest Avenue
Independence, Missouri 64050

BAILEE: _____
Contractor / Supplier

PROJECT: _____

LOCATION OF STORAGE: _____

The goods and materials described below are held and stored pursuant to the Contract by and between Bailee, as Contractor/Supplier, and Independence School District of Independence, Missouri in Jackson County as Owner, for Work to be performed at the above referenced Project Location. Said goods and materials are to be transferred or delivered to the Project site in conjunction with the performance of Bailee's Contract referenced above or upon the direction of Bailor or its General Contractor and no other. The Bailee acknowledges that it has not ownership rights or title in, nor shall claim any lien upon, said goods and materials.

QUANTITY	DESCRIPTION OF ITEM
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Receipted and Acknowledged by:

_____
Contractor / Supplier (Bailee)

On this _____ Day of _____, 20_____

DOCUMENT 006277 – BILL OF SALE

1.1 BILL OF SALE

A. The Form of the Bill of Sale is bound hereinafter for Contractor's use and duplication.

END OF DOCUMENT 006277

BILL OF SALE

SELLER: _____, Subcontractor or Supplier

_____, Address

_____, City, State Zip

In consideration of payments made pursuant to its Contract with Board of Education of Independence School District of Independence, Missouri in Jackson County as Owner, Buyer, dated _____ _____ , 20___ for the Project known as _____, receipt of which is hereby acknowledged, Seller does hereby grant, sell, transfer, and deliver to Buyer right, title, and interest in the following goods:

_____
_____
_____
_____
_____

Buyer shall have all rights and title to the goods in himself and his executors, administrators and assigns. Seller is the lawful owner of the goods and the goods are free from all encumbrances. Seller has good right to sell the goods and will warrant and defend the right against the lawful claims and demands of all persons. It is expressly understood and agreed that the acceptance of the goods described herein is not a waiver of any right of action that the Buyer may have for breach of warranty of any other cause under the Contract referenced above or at law.

In Witness Whereof, Seller has executed this Agreement the _____ day of _____, 20_____.

Seller: _____ (subcontractor, supplier)

By: _____

Title: _____

ASSIGNMENT OF BILL OF SALE

_____, in consideration of payments made by _____, Owner, pursuant to its Contract dated _____ _____, 20_____ for the project known as _____ does hereby assign this Bill of Sale to Owner.

By: _____

Title: _____

Date: _____

DOCUMENT 007200 – GENERAL CONDITIONS

1.1 APPLICABLE DOCUMENTS

A. The American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2007 Edition, is part of the Contract Documents and is included by reference, as amended by Document 007300 "Supplementary Conditions" and Document 007400 "Special Conditions.

B. Copies of the General Conditions may be obtained, at cost, from the Kansas City Chapter, of the American Institute of Architects, at the address listed below:

AIA Kansas City
1801 McGee, Suite 100
Kansas City, Missouri 64108
Telephone: (816) 221-3485.
www.aiakc.org

END OF DOCUMENT 007200

DOCUMENT 007300 - SUPPLEMENTARY CONDITIONS

The following supplements modify AIA Document A201-2007, "General Conditions of the Contract for Construction". The Article numbers herein refer to the same Article numbers in that Document. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions remain in effect.

ARTICLE 1 - CONTRACT DOCUMENTS

Add to the end of Subparagraph 1.1.3:

1.1.3 The work referred to in these documents consists of the furnishing of all labor, materials and equipment for the complete installation of all work specified herein and shown on the drawings, including; hauling off, delivery, unloading, uncrating, assembly, setting-in-place, leveling, completely installed and clean up of any debris.

Add the following definitions:

1.1.9 Product: Materials, systems and equipment incorporated or to be incorporated in the Work.

1.1.10 Provide: Furnish and install and shall include, without limitation, labor, materials, equipment, transportation, services and other items required to complete the referenced tasks.

1.1.11 Furnish: Pay for, deliver (or receive), unload, uncrate, inspect and store as specified or directed while retaining care, custody and control until received for installation by others based on a signed receipt.

1.1.12 Install: Receive, unload, uncrate, inspect and store as specified or directed while retaining care, custody, and control; set or place in position, make required connections, adjust and test for satisfactory performance and operation.

1.1.13 Not In Contract (N.I.C.): Products not in Contract, but which may require provisions in the Work for future installation.

1.1.14 By Owner Future (B.O.F.): Items furnished and installed by Owner and are not in the Contract but may require rough-in services, blocking and anchorage devices, for future installation.

1.1.15 By Owner (B.O.): Items ordered, paid for and shipped to Project by Owner. Contractor shall receive, unload, unpack or uncrate, protect, move into place, install and connect items.

1.1.16 Relocate Existing (R.E.): Existing items requiring relocation under the Contract and which may require service disconnection and capping and new service connections.

Add Clause 1.2.2.1:

1.2.2.1 The terms "this Contractor", "furnished under other sections", "included as part of other sections", "related work in other sections", or similar description of segregation shall not be interpreted to limit the responsibility of any particular party involved in the work. The limitations of any subcontractor's work shall rest solely upon the agreement between the General Contractor and the Subcontractor, regardless of where the work is called for in the Contract Documents.

Add Clauses 1.2.3.1 and 1.2.3.2:

1.2.3.1 When, in the Specifications, a word such as "approved equal", “approved substitute”, "satisfactory", "comparable product", "as directed", etc., is used, it implies such reference is to the Architect's specific approval and directions. Whenever substitutions; products, materials and equipment not originally specified, alter the design or space requirements indicated on the plans, the Contractor shall include all items of cost of the revised design and construction, including costs of all allied trades involved.

1.2.3.1 Whenever the words "necessary", "proper", or words of like effect are used in the Contract Documents with respect to the extent, conduct, or character of work specified, they shall mean that the said work shall be carried to the extent, must be conducted in a manner, or be of a character which is "necessary" or "proper" under the circumstances in the opinion of the Architect, and the Architect's judgment in such matters shall be considered final.

Add Subparagraphs 1.2.4 through 1.2.6:

1.2.4 In case of actual or alleged conflicts or inconsistencies between Drawings and Specifications, Schedules, or other Contract Documents, or within any Document not clarified by addendum; the better quality and greater quantity of Work consistent with the design indicated, shall be deemed to be the basis of the Contractor's Bid and the Contract Sum. Failure to report alleged conflicts and inconsistencies in the Contract Documents shall be deemed as evidence that the Contractor has elected to proceed in the more expensive manner, as the basis of the Contract Sum. Work involving any alleged conflict or inconsistency shall be provided in accordance with the Architect's interpretation.

1.2.5 Where items are specified by use of reference standard specifications or to codes of local or state authorities, the date of the reference shall be the latest edition published as of the date of the Agreement, unless a specific edition is referenced in the Specifications or in an applicable code, in which case the code reference to the specific edition shall govern.

1.2.6 Materials which are shown on the Drawings and which may not be specifically described in the Specifications or on the Drawings, shall be compatible with adjacent materials, and shall be subject to review and acceptance by the architect for conformance with the intent of the Contract Documents. Where installation techniques are not specified, installation shall be in accordance with the manufacturer's current instructions and industry standards, as acceptable to the Architect.

Add Paragraph 1.6.1:

1.6.1 Contractor's Use of Instruments of Service in Electronic Form.

1.6.1.1 The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

1.6.1.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect.

ARTICLE 2 - OWNER

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

Section 2.2.1. Delete entire section.

Section 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. **If the Contractor has reason to believe the information provided by the Owner is inaccurate, the Contractor shall notify the Owner and Architect in writing as soon as practicable.**

Section 2.3. If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or ~~repeatedly~~ fails to carry out Work in accordance with the Contract Documents…

Delete Subparagraph 2.2.5 and substitute the following:

2.2.5 The Contractor will be furnished, free of charge, two copies of Drawings and Project Manuals. Additional sets will be furnished at cost of reproduction, postage and handling.

Revise Paragraph 2.4. as follows:

In the first sentence, DELETE "a ten-day period" and INSERT in it's place, "forty-eight hours". In the second sentence, DELETE the word "reasonable".

ARTICLE 3 - CONTRACTOR

Add clause 3.2.2.1:

3.2.2.1 In case of actual or alleged conflicts or inconsistencies between Drawings and Specifications, Schedules, or other Contract Documents, or within any Document not clarified by addendum; the better quality and greater quantity of Work consistent with the design indicated, shall be deemed to be the basis of the Contractor's Bid and the Contract Sum. Failure to report alleged conflicts and inconsistencies in the Contract Documents shall be deemed as evidence that the Contractor has elected to proceed in the more expensive manner, as the basis of the Contract Sum. Work involving any alleged conflict or inconsistency shall be provided in accordance with the Architect's interpretation.

Add Subparagraph 3.2.5:

3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

Add Clause 3.4.2.1:

3.4.2.1 After the Contract has been executed, the Owner and Architect will consider requests for substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications). Substitutions to be made in accordance with Article 7 and as set forth in Sections 012500 and 016000.

.1 After execution of the Contract, substitutions for specified materials constitute "changes in the work" and may be proposed by the Contractor up to thirty (30) days after date of Award of the Contract only on condition that either:
  .a Specified item has been discontinued or is unavailable in time frame to meet the Project schedule due to conditions beyond the control of the Contractor, or
  .b Specified item has been determined to be unsuitable for the Project, or
  .c Owner will benefit by a reduced cost or an improved Project. Owner is to receive full benefit of any cost reductions.

.2 Requests for substitutions shall comply with requirements specified in Section 01300, in addition to including the following:
  .a Statement of cause for request with substantiating documents.
  .b Documentary proof of equal or superior quality, delivery time, and costs in the form of certified quotations from suppliers of both specified and proposed items. Approved substitutions will be incorporated into the Work by Change Order under provisions of Article 7.

Add Clause 3.4.2.2:

3.4.2.2 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

Section 3.4.3. The Contractor shall enforce strict discipline and good order among the Contractors, 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. **Contractor shall not employ persons to carry out the Work to which Owner makes reasonable written objection.**

Add Subparagraph 3.6.1:

3.6.1 The Owner is sales tax-exempt under State of Missouri Statutes. A Missouri Project Exemption Certificate approved by the Missouri Department of Revenue and a copy of the Owner's current 'Missouri Tax Exemption Letter' will be furnished to the Contractor as authorization to purchase, on behalf of the Owner, all tangible personal property and materials to be incorporated or consumed in the construction of the Project on a sales tax-exempt basis. The Contractor shall furnish copies of the Exemption Certificate and Missouri Tax Exemption Letter to its Subcontractors and Material Suppliers on this Project.

.1 Procedure for obtaining those exemption certificates - Contractor shall submit a complete list of Subcontractor's who will be working on the project along with their addresses, phone numbers and contact persons to the Architect to forward to the Owner. The Owner will type all information on the Missouri Project Exemption Certificates and mail back to the Contractor. The Contractor shall keep a copy of each of these certificates in his file and mail a set to each of his Subcontractors.

.2 There will be a Certificate Expiration Date on the Missouri Project Exemption Certificates which will correspond with the Estimated Project Completion Date. If this data should have to be extended, the Contractor shall contact the Architect and the School District for a revised expiration date. A revised Missouri Project Exemption Certificate will be issued to you reflecting the revised expiration date. The Contractor shall submit, to the Owner, a list of all Subcontractors still working on the project at that time who will need the revised Missouri Project Exemption Certificate.

.3 A copy of these certificates will be on file with the Owner.

Section 3.7.2. The Contractor shall comply 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. **If the Contractor performs any Work in a manner contrary to such laws, ordinances, rules and regulations, and without such notice to Architect, he shall assume full responsibility therefore and shall bear all costs attributable thereto**

Section 3.7.4. Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event less than 21 days after first observance of the conditions. **Contractor waives any claim for additional cost or time if it fails to comply with this notice provision.** 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…

Section 3.7.5. (ADD THE FOLLOWING) Any reference in the Specifications text to codes, standard specifications or manufacturer's instructions shall mean the latest printed edition of each in effect at the Contract date, unless specifically designated otherwise.

Section 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 not later than fourteen (14) days after the date of Agreement**, and a schedule for the critical path for the Work.** The schedule shall be updated during construction as required to keep it current. The schedule shall not exceed time limits current under the Contract Documents. Nothing in this requirement shall be deemed to be an usurpation of the Contractor's authority and responsibility to plan and schedule the Work as he sees fit, subject to all other requirements of the Contract Documents…

Add Subparagraph 3.10.4:

3.10.4 The Contractor, Subcontractors, sub-subcontractors and material suppliers shall furnish sufficient forces, construction plant and equipment, and shall work such hours as may be necessary to ensure the timely execution of the Work in accordance with the time limits set forth in the Contract Documents. If, in the opinion of the Owner, the Contractor falls behind the time constraints indicated in the Construction Progress Schedule, the Contractor shall take such steps as may be necessary to improve the progress of the Work. The Owner may require the Contractor to increase the number of shifts, and/or overtime operations and days of the work including holidays, Saturdays and Sundays, all without additional cost to the Owner.

Add Subparagraphs 3.11.1 and 3.11.2:

3.11.1 The Contractor shall keep up-to-date a complete "as built" set of blue line or black line prints, which shall be corrected to show all changes in layout from the original drawings and specifications, and General Work not issued as detail sheets. Prints for this purpose will be furnished by the Architect. This set of drawings shall be kept on the project and used only for this purpose.

3.11.2 On completion of the project, a new set of prints shall be obtained from the Architect, and a competent draftsman shall redraw neatly in black pencil all changes as noted on the record set, including the location of capped pipes by two dimensions, depth below grade or invert elevation; actual invert elevation for all soils and waste; additional valves, drains, cleanouts, changes in conduit routing, changes in wiring, changes in pull or junction boxes, etc., and change orders issued during construction. If the field record set is kept in a neat manner, it may be submitted for the final set. Final payment will not be authorized until these are received and checked for completeness.

Add Clause 3.12.8.1:

3.12.8.1 When several materials are specified by name for any one use or when an "as approved equal" or "comparable product" is allowed, the Contractor may select from any of those so specified, or may propose a substitution which he is certain fulfills the intended performance, design, hook-up, and/or space intent of the plans and specifications. Administrative and Procedural Requirements for Substitutions are set forth in Sections 012500 and 016000.

Add Clause 3.12.12

3.12.12 Manufacturer's Instructions: Where any item of work is required by Specifications to be furnished, installed or performed in accordance with a specified product manufacturer's instructions, Contractor shall procure and distribute the necessary copies of such instructions to all concerned parties.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

Add Clause 4.2.2.1:

4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

ARTICLE 5 - SUBCONTRACTORS

Revise Subparagraph 5.2.1 as follows:

In the first sentence delete "as soon as practicable" and insert "no later than seven days".

Add Clause 5.2.1.1:

5.2.1.1 Notice of no reasonable objection shall in no way be construed or indicate prior acceptance or approval of materials or equipment for which persons or entities may be agents or representatives, and shall not relieve the Contractor from full and complete responsibility for the quality of the Work and performance of those with whom the Contractor executes a contract.

Add Subparagraph 5.3.1:

5.3.1 The Contractor shall require each subcontractor to designate one individual as the on-site foreman/supervisor of the Subcontractor's work, who shall direct the Work at all times the Subcontractor is performing work and who shall confer with the Contractor before reducing his/her work forces or leaving the project unsupervised. The foreman/supervisor shall act for the Subcontractor in all areas as designated by the Subcontract.

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTOR

Section 6.1.4. Delete entire section.

Section 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 Contractors incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction**, but only if Contractor submits a timely claim pursuant to Article 15.**

ARTICLE 7 - CHANGES IN THE WORK

ADD the following Article 7.2.3 to Article 7.2:

7.2.3 Costs to be considered in determining a change in the Contract Sum under subparagraphs 7.1.3 and 7.1.4 shall be limited to the following: 1) Cost of materials, including cost of delivery and any applicable taxes; (2) Cost of labor, including insurance and mandatory and customary employee benefits (cost of labor may include the prorate time of a foreman only when an extension of Contract time is granted on account of the change); (3) Rental cost of power tools and power equipment, and any taxes legally applicable to such rental costs; (4) The cost of Subcontract work which shall be computed as set forth in this subparagraph. All costs other than for items (1), (2), (3), and (4) hereof are considered to be included in overhead expense.

Modify Subparagraph 7.3.8:

Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect including an allowance for overhead and profit.

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 or decrease, if any, with respect to that change.

Add Subparagraph 7.3.11

7.3.11 In Subparagraph 7.3.7, the allowance for the combined overhead and profit included in the total cost to the Owner for increase and decrease change orders shall be based on the following:

7.3.11.1 The allowances to the Contractor for Work performed by the Contractor with the Contractor's own forces and for materials purchased directly by the Contractor (not through a Subcontractor).

7.3.11.2 The allowances to the Contractor and Subcontractor for Work performed by the Subcontractor with that Subcontractor's own forces or purchased directly by that Subcontractor (not through a Sub-subcontractor).

7.3.11.3 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.7.

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

ARTICLE 8 - TIME

ADD the following sentences to Article 8.3.1.:

If the Contractor is delayed at any time due to a general "area-wide" strike then the contract time shall be extended by Change order for such reasonable time as justified in writing by the Contractor. All other delays shall be overcome by adjusting work schedule to include second and/or weekend work shifts.

Revise Subparagraph 8.3.2 to read as follows:

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15. **Claims relating to time not made in accordance with Article 15 are waived.** All claims for extensions of time shall be made in writing (stating dates and causes) to the Architect each month and shall accompany the Application for Payment; otherwise, they shall be waived. In the case of continuing cause of delay, only one claim is necessary.

ARTICLE 9 - PAYMENTS AND COMPLETION

DELETE Article 9.3.1 in its entirety and SUBSTITUTE the following:

9.3.1 At least ten (10) days before each progress payment falls due, the Contractor shall submit to the Architect an itemized Application for Payment based on the previously approved schedule of values, of ninety percent (90%) of the value of labor and materials suitably stored at the site, up to and including the last day of the preceding month, less the aggregate total of all previous payments; provided the aggregate total of all monthly payments shall not exceed ninety percent (90%) of the Contract Price. Applications for payment shall be supported by data substantiating the Contractor's right to payment as the Owner or the Architect may require.

Add Clause 9.3.1.1:

9.3.1.1 The Contractor shall submit three (3) of each of the following: Notarized applications for payment; previous month's affidavits and partial liens waivers from Contractor, Subcontractors and material suppliers, and supporting documents. Non-Negotiable Bailment Receipt form and Partial Lien Release form are included at the end of this Section for use.

Add new Subparagraphs 9.4.3 and 9.4.4:

9.4.3 Per Article 9.3.1 above, from each progress payment the Owner shall retain ten percent (10%) until completion and acceptance of all work under this Contract

9.4.4 At the time of issuance of Substantial Completion documentation by the Architect, the Owner will, if in his opinion the Contractor has shown due diligence towards completing the project in a timely manner and with quality workmanship, reduce the retainage from ten (10) percent to five (5) percent during the completion of Punch List work and related Project Closeout procedures. This action is strictly at the Owners discretion and not a requirement nor part of the terms of the Contract and therefore not subject to negotiation by any parties to the Contract.

Add to Subparagraph 9.6.1:

The Architect may decline to approve any Application for Payment and the Owner shall not be required to make any Progress Payments or Final Payment to the Contractor if the Contractor is in violation of any term or condition of this Agreement, the General Conditions of the Contract (AIA Document A201), or the Supplementary Conditions, or if the Contractor fails to timely provide any information reasonably requested by Owner.

Section 9.7 Failure of Payment. If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect ~~or awarded by binding dispute resolution~~, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owning has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and startup, plus interest as provided for in the Contract Documents. **Contractor shall not utilize this section if it only disputes the amount certified for payment by the Architect.**

Add to Subparagraph 9.8.1:

The Contractor and each Subcontractor shall carefully and regularly check their work for conformance as the work is being done. Unsatisfactory work shall be corrected as the work progresses and not be permitted to remain and become a part of the Punch List. When the Contractor determines that the entire work is ready for the Punch List inspection, he shall so notify the Architect/Engineer, who shall make arrangements for his Punch List inspection at the earliest possible date. Transmittal of the Punch List to the Contractor shall set the date for a Reinspection prior to issuance of a Certificate of Substantial Completion. Upon receipt of the Punch List, the Contractor shall within seven (7) days bring to the attention of the Architect/Engineer any questions that he or any of his Subcontractors may have concerning the requirements of the Punch List. When advised by the Contractor that all items on the Punch List have been completed and/or corrected, the Architect/Engineer shall make a Reinspection and shall be accompanied by the Contractor, any needed Subcontractors (and the Owner's representative where applicable) to determine whether the Certificate of Substantial Completion can be issued. When issued, the Certificate of Substantial Completion shall name the date, triggering the beginning of the Warranty period (with any items to have a later starting date specifically noted). The Certificate of Substantial Completion shall also have attached to it the uncompleted Punch List items, and shall name the date for their completion. The Certificate of Substantial Completion shall also state the responsibilities of the Owner and the Contractor for maintenance, heat, utilities, insurance, and building security. Acknowledgment of the Date of Substantial Completion by the signature of all parties on the Certificate implies possession of the premises by the Owner, and completion of incomplete Punch List items by the Contractor and the Subcontractors at the Owner's convenience. The Owner shall cooperate in permitting the Contractor access to the work for the completion of Punch List items.

Add Clause 9.8.3.1:

9.8.3.1 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

Section 9.9.3. Unless otherwise agreed upon, **in writing**, 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.

Add Clause 9.10.1.1:

9.10.1.1 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

Add Clause 10.3.1.1:

10.3.1.1 The Work shall be asbestos free. The Contractor shall, if requested, provide certification which attests to same. Reference in the technical specifications to Manufacturers, model numbers, equipment, material, article or precess shall be regarded as establishing a standard of quality and/or function. The Contractor shall submit a request for substitution on any item which can not be certified to be asbestos free.

Add Paragraph 10.5 as follows:

10.5 SAFETY AND HEALTH REGULATIONS

10.5.1 The Contract Documents and the joint and several phases of construction shall be governed at all times by applicable provisions of the Federal laws, including but not limited to, the *LATEST* amendments of the following:

Williams-Steiger Occupational; Safety and Health Act of 1970, Public Law 91-956.

Part 1910-Occupational Safety and Health Standards, Chapter 17 of Title 29, Code of Federal Regulations.

Part 1518 - Safety and Health Regulations for Construction, Chapter 13 of Title 29, Code of Federal Regulations.

ARTICLE 11 - INSURANCE

Add to Subparagraph 11.1.1:

11.1.1 In the first line after the word "from", add the following: "...an insurance carrier licensed to do business in the state of Missouri; carries a Best's policyholder rating of "A" or better; and carrier at least a Class X financial rating." In the second line after the word "Contractor ", add the following: "...Owner and Architect ." In the fifth line after the word "them", add the following: "...the Contractor shall either cover all Subcontractors or require each Subcontractor not so covered to secure insurance in the minimum amounts required of the Contractor."

Add to Subparagraph 11.1.4:

Contractor shall take out, pay for and maintain at all times during the prosecution of the work under the contract, the following forms of insurance, by carriers acceptable to and approved by Owner.

11.1.4.1 Statutory Workmen's Compensation and Employer's Liability Insurance: The Contractor shall procure and shall maintain during the life of this Contract, Statutory Compensation Insurance and Employer's Liability Insurance with limits as shown below for all of his employees to be engaged in work for the project under this Contract. In case of any such work sublet, the Contractor shall similarly require Subcontractors to provide Statutory Workmen's Compensation Insurance and Employer's Liability Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Workmen's Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this Contract is not protected under the Workmen's

Compensation Statute, the Contractor shall provide, and shall cause such Subcontractor to provide, adequate Employer's Liability Insurance for the protection of such of the employees as are not otherwise protected.

Workers' Compensation and Employers' Liability (Per Contract)

Each Accident	$500,000
Disease - Policy Limit	$500,000
Disease - Each Employee	$500,000

11.1.4.2 Contractor's General Public Liability and Property Damage Insurance including vehicle coverage issued to the Contractor and protecting the Contractor from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the Contract Documents, whether such operations be by the Contractor or by any Subcontractor employed by the Contractor or anyone directly or indirectly employed by the Contractor or by a Subcontractor employed by the Contractor and also to include coverage for Products and/or Completed Operations. Insurance shall be written with limits as shown below for injury and/or property damage liability.

Combined Single Limit Bodily Injury and Property Damage (Per Contract)

$1,000,000 per Occurrence
$1,000,000 General Aggregate

Automobile Liability
(Including Owned, Hired and Non-owned Vehicles) (Per Contract)

Combined Single Limit Bodily Injury and Property Damage
$1,000,000 per Accident

Excess Liability - Umbrella Form (Per Contract)

Combined Single Limit Bodily Injury and Property Damage
$2,000,000 per Occurrence

11.1.4.5 Proof of Carriage of Insurance: The Contractor shall furnish the Owner with a satisfactory proof of carriage of the insurance required. Certificates of insurance will be required in duplicate for file with the Owner and with the A/E, such certificates to provide that the Owner is entitled to the same notice as that given to the purchaser of the insurance in case of cancellation or any major change therein."

Section 11.2. Owner's Liability Insurance. The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance. **Purchase of any insurance required by this Contract shall not constitute a waiver of Owner's sovereign or governmental immunity.**

Delete Subparagraph 11.3.1.4 and substitute the following:

11.3.1.4 The Contractor shall provide insurance coverage for portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit.

Add the following Clause 11.3.1.6:

11.3.1.6 The insurance required by paragraph 11.3 is not intended to cover machinery, tools and equipment owned or rented by the Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools and equipment, which shall be subject to the provisions of Subparagraph 11.3.7.

Section 11.3.7. Waivers of Subrogation. **If permitted by their respective insurers,** the Owner and Contractor waive all rights against…

Section 11.4.1. The Owner shall ~~have the right to~~ require the Contractor to furnish bonds covering faithful performance of the Contract and payment obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

ARTICLE 12 - UNCOVERING AND CORRECTION OF THE WORK

Add the following Clause 12.2.2.4:

12.2.2.4 Upon request of the Owner and prior to the expiration of one (1) year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

Section 13.1. Governing Law. The Contract shall be governed by the law of the place where the Project is located **state of Missouri** except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

Add Subparagraph 13.1.1:

13.1.1 Environmental Performance: In order to secure approval to proceed with construction, the Owner is committed to comply with the Environmental Protection Agency rule under Section 203 of Title II of the Toxic Substance Control Act (TSCA), 15 U.S.C. 2643 which requires all local educational agencies to identify asbestos containing materials in their school building. The Contractor shall certify that all materials furnished and installed in this project are asbestos free in conformance to the Environmental Protection Agency requirements.

ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

Section 14.1.1.4 Delete this section.

Section 14.2.1.1 ~~repeatedly~~ refuses or fails to supply enough properly skilled workers or proper materials;

Section 14.2.1.3 ~~repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

ARTICLE 15 - CLAIMS AND DISPUTES

Section 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 Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party 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. **The written notice must state that a claim is being made pursuant to this section. Untimely Claims are waived.**

Section 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. **Contractor waives Claims for an increase in the Contract Sum if it does not provide said written notice 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.

Section 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 Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation **or litigation** of any Claim arising prior to the date final payment is due, unless 30 days has passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

Section 15.3.1. Claims, disputes or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to ~~binding dispute resolution~~ **litigation.**

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

Section 15.4. **Arbitration**. Delete entire section and its subsections.

Section 15.4.4. **Consolidation or Joinder**. Delete entire section and its subsections.

Delete Clause 15.1.5.2 in its entirety and Substitute:

15.1.5.2 The following are considered reasonable anticipated days of adverse weather on a monthly basis and shall be included in the Contract Time:

January	6 days	April	3 days
February	4 days	May	4 days
March	3 days	June	3 days

Adverse weather days beyond the above total annual allotted number will be allowed to extend the Contract Time only if authorized by the Architect and Owner.

Add Clause 15.1.5.3:

15.1.5.3 An adverse weather day is defined as a calendar day where at least four (4) hours of work on the principle unit of Work underway, between the hours of 7:00 a.m. and 4:00 p.m., cannot be completed because of weather conditions beyond the Contractor's control. The allotted days are for the month stipulated and may not be accumulated or carried over.

Add Clause 15.1.5.4:

15.1.5.4 Adverse weather days shall be recorded and submitted, in writing, for the Owner's and Architect's review and approval on a monthly basis.

Add Clauses 15.1.5.5 and 15.1.5.6:

15.1.5.5 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis for the Claim.

15.1.5.6 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

END OF SUPPLEMENTARY CONDITIONS

SECTION 007400 - SPECIAL CONDITIONS

1.1 GENERAL: The Division of the body of these Specifications into various Sections is done for clarity in the explanation of the individual parts of the whole work. It is not the intent of such division to develop any secondary responsibilities for the satisfactory completion of the work as required by the Drawings and Specifications. Along those same lines, assignment by the Architect of parts of work to any trade or craft is not to be inferred from these Documents.

1.2 CODES, LAWS, STANDARDS, and PERMITS

A. Contractor's performance, workmanship and material shall comply with all governing codes, state statutes and regulations, city ordinances and regulations of regulatory bodies having jurisdiction.

B. The Contractor shall comply with rules and regulations of public utilities and municipal departments affected by work under this contract.

C. Laws, codes, ordinances and regulations shall take precedence, excepting only where work called for by the Drawings and Specifications exceeds code requirements in quality and/or quantity.

D. It will be the responsibility of the Owner to pay, apply and obtain the General building permit. For ALL other permits required to complete the work by additional trades it will be the responsibility of the contractor and or subcontractor to obtain and pay for any such permits.

E. ALL Contractors working on this project are required to have a current Business License in Independence, MO. It will be the responsibility of the General Contractor to advise all subcontractors of this requirement as well as providing a List of All Contractors working on the project to the Business License Compliance Offer at the City of Independence, MO. Applications for Business Licenses generally take two (2) weeks to process.

1.3 QUALIFICATIONS OF CONTRACTORS: All Contractors shall be a qualified with histories of successful performance acceptable to the Owner / Architect.

A. Labor and Workmanship: All labor for the installation of material and equipment furnished under this Contract shall be done by experienced mechanics of the proper trade. All workmanship shall be first class and in compliance with the specific requirements of Drawings and Specifications.

B. All contractors bidding on construction contracts which exceed $500,000.00 with the Independence School District shall meet qualification standards prior to acceptance of any bid.

C. The District shall investigate and examine the qualifications of all concerns and, upon determining that a contractor meets the requirements of this policy and is in all respects responsible, qualified and competent for the class, character and magnitude of the work which the applicant proposes or intends to perform under this proposed contract shall then be determined to be qualified to be awarded a bid.

D. In determining the acceptability of a contractor for the purpose of qualification, the District shall investigate and consider at least the following:

1. Financial responsibility.
2. The character, quality and availability of the contactor’s equipment.
3. The performance record of the contractor in the performance of other contracts for public or private improvements.
4. The nature and extent of other contract commitments involving the use of contractor’s machinery, equipment and personnel.
5. The reputation for reliability and integrity.
6. History of compliance with applicable State and Federal laws.
7. Compliance with MBE/WBE Policies.
8. The source of any labor involved in the project.
9. Any other fact which would materially affect the ability of the applicant to properly, adequately, expeditiously and satisfactorily perform such work as might be awarded to such contractor.

E. To be determined qualified the contractor must provide or participate in each of the following for the benefit of its employees and in addition, the contractor will certify that all subcontractors under their control will comply with the following:

1. An ERISA-qualified medical welfare benefit plan or health insurance in some form.

2. A training program approved by and registered with the U.S. Department of Labor's Bureau of Apprenticeship and Training or equivalent.

3. An ERISA-qualified pension plan or a retirement benefit program.

F. Under no circumstance shall a contractor be qualified who fails to provide or participate in any of the aforementioned programs.

1.4 QUALIFICATIONS OF MANUFACTURER: Products used in the work of this specification shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/Engineer.

1.5 CONTRACTS: When entering into any contract which excels $500,000.00 involving labor or hiring any labor for public contract work, preference may be given to contractors, mechanics, artisans or other laborers of any class, who shall have actually resided in Jackson County, Missouri, for a period of six months preceding the start of their engagement.

A. A contract or purchase may be awarded to a bidder utilizing local labor where the bid by such bidders is, in all material respects, comparable to the lowest responsible bid not utilizing local labor if the amount bid (labor, materials, and other services) by such bidder does not exceed the lowest bid not utilizing local labor by more than the following percentages, unless such an award is contrary to State or Federal law or regulations or unless the District, at its discretion, determines prior to giving notice soliciting bids that the provisions of this section shall not apply to the contract or purchases.

1. $0 to $500,000.00 – No preference

2. $500,000.00 to $1,000,000.00 – 5 percent on the first $500,000 and no adjustment for the amount between $500,000.00 and $1,000,000.00

3. $1,000,000.00 and Greater – 5 percent higher on the first $500,000.00 and 2.5 percent on amount between $500,000.00 and $1,000,000.00

4. No additional adjustment for amounts in excess of $1,000,000.00

B. The amount of any preference awarded will be based on the maximum preference awarded for size of the contract multiplied by the percentage of local labor compared to the total labor for the work.

1.6 CONSTRUCTION DOCUMENTS: Prior to the start of construction, if requested, the Contractor will be provided up to a maximum of fifteen (15) sets of contract documents, specifications and drawings for use during the construction phase.

1.7 CONTRACTOR'S MATERIALS: All materials delivered to the Job Site shall be stored so as to be kept in First Class condition. Materials and equipment to be left on the job overnight shall be stored in a secure, weatherproof manner.

1.8 UTILITIES: Access to electrical and water utilities shall be provided by the Owner in reasonable quantities at no cost to the Contractor. The contractor shall be responsible for ALL extensions, modifications and applicable fees for these utilities to adapt them to his use.

1.9 TOILETS: The Contractors shall provide their own restroom facilities during the execution of this project. Contractor shall coordinate location of temporary facilities with Owner.

1.10 EXAMINATION OF EXISTING CONDITIONS: It is recommended that bidders visit the project sites prior to Bid Date and become familiar with all existing conditions as they apply to their area of work. Failure to do so will in no way relieve the successful bidder from being required to complete all work in compliance with these Documents.

1.11 CONTRACTOR'S SUBMITTALS: Approval of required submittals must be obtained from the Architect prior to starting any work requiring submittals as specified. The Architect will return the submittals approved or disapproved within five (5) work days after receipt. Warranties are required at the completion of the contract work and no later than thirty (30) days after final inspection. Four (4) copies of all warranties shall be provided unless otherwise specified.

A. If an item has not received a positive review by the second submittal, any subsequent reviews by the Architect will be paid for by the Contractor at the rate of one-hundred dollars ($110.00) per man-hour for review time until final approval is granted.

1.12 EXISTING BUILDING ACCESS

A. All access through the existing buildings shall be coordinated with the Owner. The Contractor shall protect the interior floors, walls and ceilings from damage caused by such access.

B. All finished surfaces of the existing building are assumed to be in good condition. It will be the responsibility of the Contractor to repair any damage caused during the course of the project and at no additional expense to the Owner. The Contractor shall, at his own option, inspect those areas affected by the new work, documenting any existing damage, and report same to the Owner / Architect at the Pre-Construction meeting.

1.13 **CONSTRUCTION TIME: Time is of the essence in this project. It is important that the work is completed in a timely manner and by the dates specified below.**

A. ALL WORK MUST BE SUBSTANTIALLY COMPLETE by no later than **dates listed below**

B. ALL Punch List work MUST BE COMPLETED by no later than **dates listed below.**

	SUBSTANTIAL COMPLETION	FINAL COMPLETION
CENTRAL WAREHOUSE	**17 MAY 2016**	**26 MAY 2016**

1.14 LIQUIDATED DAMAGES: Should **ANY** portion of the project exceed the time limits referenced above and as noted on the Bid Proposal, a measure of Liquidated Damages in the amount of **$500.00,** per calendar day, will be assessed against the Contractor and the Sum shall be deducted from the Contract Amount, being conclusive as to the failure of completion within the time stated, regardless of actual damages.

1.15 PREVAILING WAGES: This is a Prevailing Wage project. Prevailing Wage information, including the applicable Wage Rates are included in another portion of these Documents for the Contractors review and use. The Contractor shall follow and enforce all requirements of the Prevailing Wage Law.

1.16 CLEANING AND ADJUSTMENT: Dirt and refuse resulting from the performance of the work shall be removed from the premises as required. Upon completion of the installation, visually inspect each installed item, thoroughly clean all surfaces by using the cleaning material recommended by the manufacturer of the finish being cleaned, and carefully adjust all operating components for optimum operation. All debris shall be kept to a minimum and at no time shall create a hazard to the occupants of the other buildings.

A. In addition to clean-up provisions of the Specifications, Contractor shall take appropriate steps to prevent airborne dust due to work under this Contract. Water shall be applied wherever practical to settle and hold dust to a minimum, particularly during demolition and moving of materials.

1.17 RECORD DRAWING INFORMATION: Contractor shall designate one set of drawings and specifications as "*RECORD DRAWING INFORMATION DOCUMENTS*". Any changes are to be documented on these drawings and specifications. These documents shall be submitted to the Architect as part of the Close-out Documentation.

1.18 EMPLOYMENT VERIFICATION SYSTEM: Prior to commencement of the Work, Contractor shall provide to Owner a sworn affidavit and other sufficient documentation to affirm its enrollment and participation in the federal work authorization program. Federal work authorization program means the E-Verify Program maintained and operated by the United States Department of Homeland Security and the Social Security Administration, or any successor program. Contractor shall also provide Owner a sworn affidavit affirming that it does not knowingly employ any person who is an unauthorized alien in connection with the contracted services.

1.19 OSHA REQUIREMENTS: Contractors and subcontractors who contract to work on public works projects shall provide a 10 hour Occupational Safety and Health instruction and safety program, or similar program approved by the department of labor, for their employees. All employees working on projects must have completed the course within 60 days of beginning work and shall keep evidence of completion on the worksite.

A. Contractors and subcontractors in violation will forfeit $2,500 plus $100 for each worker employed for each day the worker is employed without training to the public body awarding the contract.

B. Public bodies and contractors may withhold assessed penalties from contractors and subcontractors respectively.

(Section 292.675, Effective date: August 28, 2009.)

END OF SECTION 007400

SECTION 008100 – PREVAILING WAGE DETERMINATION

PART 1 - GENERAL

1.1 This Project is contracted under the requirements of Missouri Prevailing Wage Law. This Section includes general information and forms for convenience. Detailed requirements, information, forms, and assistance may be obtained by contacting the following:

1. Missouri Department of Labor and Industrial Relations
   Division of Labor Standards
   Prevailing Wage Section
   PO Box 449
   Jefferson City, MO 65102-0449
   Phone: 573-751-3403
   Fax: 573-751-3721
   Email: prevailingwage@labor.mo.gov
   Website: www.labor.mo.gov/ls/prevailingwage

B. Prevailing Hourly Rate of Wages: Not less than the prevailing hourly rate of wages, as set out in the wage order attached, must be paid to all workers performing work under this Contract.

1. Contractor shall forfeit a penalty to the contracting public body of $100 per day (or portion of a day) for each worker that is paid less than the prevailing rate for any work done under this Contract by the Contractor or by any Subcontractor.
2. Submit certified copies of Contractor's and subcontractor's payrolls to contracting public body on a weekly basis.

C. Safety Training Program: All on-site employees, including those of Contractor and subcontractors, are required to complete the ten-hour safety training program required under Section 292.675 RSMo, if they have not previously completed the program and have documentation of having done so.

1. Contractor shall forfeit a penalty to the contracting public body of $2500 plus an additional $100 for each employee, including those of subcontractors, for each calendar day, or portion thereof, such employee is employed without the required training.

D. Construction Transient Employers: Every transient employer, as defined in section 285.230 RSMo, must post in a prominent and easily accessible place at the site, a clearly legible copy of the notices listed below. Any transient employer failing to comply with these requirements shall, under section 285.234 RSMo, be liable for a penalty of $500 per day until notices are posted as required by the statute:

1. The notice of registration for employer withholding issued to such transient employer by the director of revenue.
2. Proof of coverage for workers' compensation insurance or self-insurance signed by transient employer and verified by the Department of Revenue through records of the Division of Workers' Compensation.
3. The notice of registration for unemployment insurance to such transient employer by the Division of Employment Security.

E. Posting of Wage Rates: While work under this Contract is being performed, a legible list of all prevailing wage rates must remain posted in a prominent and easily accessible location at the site by the Contractor and each subcontractor on the project. Such notice shall remain posted during the full time that any worker is employed on the project.

F. Project Notification - Contractor Information Notification: Before performing any Work, submit a completed PW-2 Form "Prevailing Wage Project Notification - Contractor Information Notification," available at www.labor.mo.gov/ls/prevailingwage under "Forms," to The Division of Labor Standards (DLS).

G. Project Completion Notification – Affidavit of Compliance: Before final payment will be made, the Contractor shall file a fully executed affidavit, PW-4 Form "Affidavit – Compliance with the Prevailing Wage Law", available at www.labor.mo.gov/ls/prevailingwage under "Forms," to The Division of Labor Standards (DLS).

H. Monthly Applications for Payment: Pursuant to prevailing wage laws, an Affidavit of Compliance (Form PW-4) must be filed with the District before payment will be approved. The District will withhold and retain any amounts due as a result of any violation of the prevailing wage law prior to making payment with any contractor. Include Affidavit of Compliance with each application for payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 008100

Missouri
Division of Labor Standards

WAGE AND HOUR SECTION

JEREMIAH W. (JAY) NIXON, Governor

Annual Wage Order No. 23

Section 048

JACKSON COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
John E. Lindsey, Director
Division of Labor Standards

This Is A True And Accurate Copy Which Was Filed With The Secretary of State: **March 10, 2016**

Last Date Objections May Be Filed: **April 11, 2016**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	** Date of Increase	*	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Asbestos Worker (H & F) Insulator			$36.44	52	53	$24.58
Boilermaker			$34.76	57	7	$28.00
Bricklayer and Stone Mason	6/16		$34.35	58	39	$18.72
Carpenter	6/16		$37.25	63	68	$16.10
Cement Mason			$31.24	65	4	$18.54
Communication Technician			$33.65	47	72	$16.26 + 10%
Electrician (Inside Wireman)			$36.69	13	72	$16.95 + 10%
Electrician (Outside-Line Construction\Lineman)			$41.52	125	65	$5.00 + 34.5%
Lineman Operator			$38.37	125	65	$5.00 + 34.5%
Groundman			$26.76	125	65	$5.00 + 34.5%
Elevator Constructor		a	$43.620	26	54	$29.956
Glazier			$33.12	88	32	$16.68
Ironworker	6/16		$32.00	50	4	$28.45
Laborer (Building):						
General	6/16		$27.15	30	4	$15.45
First Semi-Skilled	6/16		$27.55	30	4	$15.45
Second Semi-Skilled	6/16		$27.95	30	4	$15.45
Lather			USE CARPENTER RATE			
Linoleum Layer and Cutter	6/16		$34.97	46	67	$16.10
Marble Mason			$34.24	25	4	$14.18
Marble Finisher			$24.11	25	4	$8.65
Millwright			USE CARPENTER RATE			
Operating Engineer						
Group I			$37.85	85	4	$15.56
Group II			$37.04	85	4	$15.56
Group III			$31.49	85	4	$15.56
Group III-A			$35.70	85	4	$15.56
Group IV						
Group V			$33.09	85	4	$15.56
Painter	6/16		$28.54	37	4	$16.56
Pipe Fitter			$43.08	2	33	$19.57
Plasterer			$31.60	68	4	$16.25
Plumber	6/16		$42.64	45	33	$21.04
Pile Driver			USE CARPENTER RATE			
Roofer \ Waterproofer	6/16		$32.55	95	2	$17.09
Sheet Metal Worker			$39.50	17	22	$20.51
Sprinkler Fitter - Fire Protection			$35.74	14	4	$18.97
Terrazzo Worker			$34.24	25	4	$14.18
Terrazzo Finisher			$24.11	25	4	$8.65
Tile Setter			$34.24	25	4	$14.18
Tile Finisher			$24.11	25	4	$8.65
Traffic Control Service Driver			$15.35	48	49	$2.71
Truck Driver-Teamster						
Group I			$30.09	100	4	$10.90
Group II			$30.09	100	4	$10.90
Group III			$30.29	100	4	$10.90
Group IV			$30.29	100	4	$10.90

Fringe Benefit Percentage is of the Basic Hourly Rate

**Annual Incremental Increase

OCCUPATIONAL TITLE	** Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits

* Welders receive rate prescribed for the occupational title performing operation to which welding is incidental.

Use Building Construction Rates on Building construction In accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

a - Vacation: Employees over 5 years - 8%; Employees under 5 years - 6%

JACKSON COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 2: Means the maximum of eight (8) hours shall constitute a day's work beginning at 8:00 a.m. to 12:00 noon, 12:30 p.m. to 4:30 p.m. The maximum work week shall be forty (40) hours beginning Monday at 8:00 a.m. and ending Friday at 4:30 p.m. Because of traffic, parking or other circumstances, the hours of work on any project may be any continuous 8½ hours period (8 hours of work plus 30 minutes for lunch) between 7:00 a.m. and 4:30 p.m. When circumstances warrant and when it is mutually beneficial and agreed to, the Employer may institute a work week consisting of four (4) consecutive ten (10) hour days, between the hours of 7:00 a.m. and 6:00 p.m. Monday through Thursday, with one-half (½) hour allowed for a lunch period each day. Friday may be used as a make-up day. After ten (10) hours in a workday, or forty (40) hours in a workweek, overtime shall be paid at a rate of one and one-half (1½) times the regular rate of pay. Overtime performed Monday through Saturday shall be paid at the rate of one and one-half (1½) times the regular rate of pay. Sundays and recognized holidays shall be paid at the double (2) time rate of pay. Labor Day shall be paid at triple (3) time. Shift work may be performed at the option of the Contractor. However, whenever shift work is performed it must cover a period not less than (5) consecutive working days. The day shift shall work a regular eight (8) hours shift as outlined above. Employees working a second shift shall receive an additional $0.25 above the regular hourly rate and perform seven and one-half (7½) hours work for eight (8) hours pay. Third shift employees shall be paid an additional $0.50 above the regular hourly rate and work seven (7) hours for eight (8) hours pay. In the event a first shift is not required, a second and third shift employee shall receive an additional 15% of the base rate and receive pay for actual hours worked.

NO. 13: Means a regular workday shall consist of eight (8) hours between 8:00 a.m. and 4:30 p.m. Forty (40) hours, within five (5) days -- Monday through Friday inclusive -- shall constitute the regular workweek. The Employer may alter the above stated hours by two (2) hours for an early starting and quitting time only, not to exceed eight (8) hours of work in any one day. When job conditions dictate and as required by the customer, the Employer shall be allowed to establish a four (4) day, ten (10) hour per day work week. This work week is defined as Monday through Thursday, with a Friday make-up day. The normal work day under a ten (10) hour four (4) day work week shall be from 7:00 a.m. to 6:00 p.m., with a one hour starting variance. The make-up day of Friday shall be instituted for specific reasons such as loss of production due to weather and/or holidays. All hours worked in excess of ten (10) hours per day or forty (40) hours per week or hours worked outside the normal work week shall be paid at the applicable overtime rate. The first four (4) hours of overtime after the normal workday, each day Monday through Friday and the first ten (10) hours of overtime on Saturdays shall be paid for at one and one-half (1½) times the regular straight time rate of pay. All other work performed outside of the regularly scheduled working hours and outside of the first ten (10) hours worked on Saturdays shall be paid for at double (2) the regular straight time rate of pay. Sundays and the recognized holidays shall be paid for at double (2) the regular straight time rate of pay, if worked. When so elected by the contractor, multiple shifts of at least five (5) days duration may be worked. When two (2) or three (3) shifts are worked: The first shift (day shift) shall be worked between the hours of 8:00 a.m. and 4:30 p.m. Workmen on the "day shift" shall receive eight (8) hours pay at the regular hourly rate for eight (8) hours work. The second shift (swing shift) shall be worked between the hours of 4:30 p.m. and 12:30 a.m. Workmen on the "swing shift" shall receive eight (8) hours pay at the regular hourly rate plus 10% for seven and one-half (7 ½) hours work. The third shift (graveyard shift) shall be worked between the hours of 12:30 a.m. and 8:00 a.m. Workmen on the "graveyard shift" shall receive eight (8) hours pay at the regular hourly rate plus 15% for seven (7) hours work. A lunch period of thirty (30) minutes shall be allowed on each shift. All overtime work required after the completion of a regular shift shall be paid at one and one-half (1½) times the "shift" hourly rate.

NO. 14: Means eight (8) hours per day shall constitute a day's work. The regular starting time shall be 8:00 a.m., and the regular quitting time shall be 4:30 p.m.; lunch time shall be twelve (12) o'clock noon to 12:30 p.m. The regular starting time may, by mutual consent of employees on the job site, and the employer, be between 7:00 a.m. and 9:00 a.m. with appropriate adjustments made to the regular quitting time and lunch time. All time worked before the regular starting time and after the regular quitting time, Monday through Friday, shall be paid at the rate of time and one-half (1½). Four (4) days at ten (10) hours a day may be worked at straight time. All work commencing with the beginning of the established work day on Saturday shall be paid at the rate of time and one-half (1½). All work commencing with the beginning of the established work day on Sundays and/or Holidays shall be paid at the rate of double (2) time.

JACKSON COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 17: Means the regular working day shall consist of eight (8) hours of labor between 7:00 a.m. and 3:30 p.m. and the regular work week shall consist of five (5) consecutive eight (8) hour days of labor beginning on Monday and ending with Friday of each week. All full-time or part-time labor performed during such hours shall be recognized as regular working hours and paid for at the regular hourly rate. Except as otherwise provided, all work performed outside of regular working hours during the regular work week, shall be at double (2) times the regular rate. Working hours may be varied by two (2) hours. When circumstances warrant and when it is mutually beneficial and agreed to by interested parties, the Employer may institute a work week consisting of four (4) consecutive ten (10) hour days, between the hours of five (5) a.m. and six (6) p.m., Monday through Thursday, with one-half (1/2) hour allowed for a lunch period each day. Friday may be used as a make-up day. The make-up day will be voluntary, and a decision not to work may not be held against the employee. When working four (4) ten (10) hour day's overtime will be paid at the time and one-half (1½) rate for the eleventh (11th) and twelfth (12th) hour, all other work will be paid at the double (2) time rate of pay. The first two (2) hours of overtime, Monday through Friday, and the first eight (8) hours on Saturday shall be at time and one-half (1½) for all work. All other overtime shall be at double (2) time. The first two (2) hours of overtime must be concurrent with the ragular work day; two (2) hours prior to or following the regular work day are at time and one-half (1½). The regular workday (as previously defined) on Saturday is paid at time and one-half (1½). Work performed outside of the regular Saturday work day is at double (2) time. All work performed on recognized holidays, or days locally observed as such, and Sundays shall be paid at the double (2) time rate of pay.

NO. 25: Means regular working hours of eight (8) hours shall constitute a working day between the hours of 8:00 a.m. to 4:30 p.m. in a forty (40) hour working week of Monday through Friday. Employment on Saturday, Sunday and legal holidays, and employment before or after the regular working hours shall be considered overtime. Employment on Saturday, Sunday and legal holidays shall be paid for at twice (2) the regular hourly rate. Employment from 4:30 p.m. to 12:00 midnight, Monday through Friday, shall be paid for at one and one-half (1½) times the regular hourly rate. From 12:00 midnight until 8:00 a.m. on any day shall be paid for at twice (2) the regular hourly rate.

NO. 26: Means that the regular working day shall consist of eight (8) hours worked between 6:00 a.m., and 5:00 p.m., five (5) days per week, Monday to Friday, inclusive. Hours of work at each jobsite shall be those established by the general contractor and worked by the majority of trades. (The above working hours may be changed by mutual agreement). Work performed on Construction Work on Saturdays, Sundays and before and after the regular working day on Monday to Friday, inclusive, shall be classified as overtime, and paid for at double (2) the rate of single time. The employer may establish hours worked on a jobsite for a four (4) ten (10) hour day work week at straight time pay for construction work; the regular working day shall consist of ten (10) hours worked consecutively, between 6:00 a.m. and 6:00 p.m., four (4) days per week, Monday to Thursday, inclusive. Any work performed on Friday, Saturday, Sunday and holidays, and before and after the regular working day on Monday to Thursday where a four (4) ten (10) hour day workweek has been established, will be paid at two times (2) the single time rate of pay. The rate of pay for all work performed on holidays shall be at two times (2) the single time rate of pay.

NO. 30: Means Monday through Sunday shall constitute the work week. Regular starting time shall be 8:00 A.M., except when the work week is scheduled as a week with starting time advanced or delayed. Starting time may be advanced or delayed by the employer up to two (2) hours from the regular starting time. Eight (8) hours shall constitute the work day. All work performed prior to or after the regular eight (8) hour work day, as described above, and all work performed on Saturday shall be paid at time and one-half (1½) the regular rate. In the event that a scheduled eight (8) hour work day is missed (not to include holidays) because of events out of the control of the contractor, then that missed work day may be made up at straight time the following Saturday. It is recognized that not all employees working on a Saturday make-up day will have worked the same number of hours during the regular work week. It is further recognized that any work after the forty (40) hours in a week must be paid at time and one-half (1½). Saturday make-up day shall not be used to make up for time lost due to recognized holidays. The employer may establish a 4-10's schedule on projects (4 days with 10 hours per day). If using a 4-10's schedule, a Friday make-up day is allowed. If using a 4 (10) schedule, any work more than ten (10) hours in a day or forty (40) hours in a work week shall be paid at the time and one-half (1½) rate. Friday make-up day shall not be used to make up for time lost due to recognized holidays. All work performed on Sundays or holidays shall be paid at the double (2) time rate.

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NO. 37: The Employer may choose, at his discretion, to work five eight hour days or four ten hour days with a Friday make-up day, Monday through Friday at straight time. Overtime shall be paid after eight (8) hours when working "five eights" and after ten hours when working "four tens". All work performed on Sundays and recognized holidays shall be paid for at the rate of double (2) time. All Saturday work shall be paid for at the rate of time and one-half (1½) the regular wage rate. All night work during the regular work week other than the above-mentioned days shall be paid for at the rate of time and one-half (1½) the regular wage scale until midnight and double (2) time after midnight except make-up time will be allowed under the following condition: In the event of inclement weather on exterior projects which prevents working the full regular eight (8) hour day, forty (40) hour work week schedule, a Saturday make-up day can be granted. Then said work on Saturday shall be paid at the straight time rate of pay up to a maximum total of forty (40) hours per week.

NO. 45: Means eight (8) hours shall constitute a day's work, beginning at 8:00 a.m. and ending at 4:30 p.m. The regular work week shall be forty (40) hours, beginning Monday, 8:00 a.m. and ending at 4:30 p.m. Friday. Because of traffic, parking and other circumstances, the hours of work on any project may begin as early as 6:00 a.m. with eight (8) hours worked between 6:00 a.m. and 4:30 p.m. When circumstances warrant and when it is mutually beneficial and agreed to, the employer may institute a work week consisting of four (4) consecutive ten (10) hour days, between the hours of 7:00 a.m. and 6:00 p.m., Monday through Thursday. Friday may be used as a make-up day. After ten (10) hours in a workday, or forty (40) hours in a workweek, overtime shall be paid at a rate of one and one-half (1½) times the regular rate of pay. All overtime Monday through Saturday shall be paid at the rate of time and one-half (1½) the regular rate of pay. Sunday and recognized holidays shall be paid at double (2) time. Labor Day shall be paid at triple (3) time. Shift work may be performed at the option of the Contractor. However, whenever shift work is performed it must cover a period not less than (5) consecutive working days. The day shift shall work a regular eight (8) hours shift as outlined above. The hourly rate for second shift (seven and one-half hours worked for eight hours paid) shall be twenty-five cents ($0.25) over and above the hourly rate. The hourly rate for third shift (seven hours worked, eight hours paid) shall be fifty cents ($0.50) above the hourly rate. If no first shift is worked, second and third shift employees shall receive an additional fifteen percent (15%) over and above the hourly rate for actual hours worked.

NO. 46: Means the regular work day shall be eight (8) hours from 6:00 a.m. to 6: 30 p.m. Starting time may be between 6:00 a.m. and 10:00 a.m. The regular work week shall be forty (40) hours, beginning between 6:00 a.m. and 10:00 a.m. on Monday and ending between 2:30 p.m. and 6:30 p.m. on Friday. All hours in excess of the regular work day and work week shall be considered overtime. Overtime on days recognized as regular work days and on Saturday shall be paid for at the rate of time and one-half (1½) the regular rate. Sunday and recognized holidays shall be paid for at the rate of double time (2) for time worked. The Employer may establish a work week consisting of four (4) days, Monday through Thursday, each day consisting of ten (10) hours at stralght time rate of pay. The 4-10's must run for a period of at least four (4) days.

NO 47: Means a regular workday shall consist of eight (8) hours between 6:00 a.m. and 6:30 p.m. Forty (40) hours, within five (5) days – Monday through Friday or Tuesday through Saturday inclusive – shall constitute the regular workweek. The Employer may alter the above stated hours by two (2) hours for an early starting and quitting time only, not to exceed eight (8) hours of work in any one day. The Employer shall be allowed to establish a four (4) day, ten (10) hour per day work week. This work week is defined as Monday through Thursday, with a Friday make-up day. The normal work day under a ten (10) hour four (4) day work week shall be from 7:00 a.m. to 6:00 p.m. All hours worked in excess of ten (10) hours per day or forty (40) hours per week or hours worked outside the normal work week shall be paid at the applicable overtime rate. The first four (4) hours of overtime after the normal workday, each day Monday through Friday and the first ten (10) hours of overtime on Saturdays shall be paid for at one and one-half (1½) times the regular straight time rate of pay. All other work performed outside of the regularly scheduled working hours and outside of the first ten (10) hours worked on Saturdays shall be paid for at double (2) the regular straight time rate of pay. Sundays and the recognized holidays shall be paid for at double (2) the regular straight time rate of pay, if worked. When so elected by the contractor, multiple shifts of at least five (5) days duration may be worked. When two (2) or three (3) shifts are worked: The first shift (day shift) shall be worked between the hours of 8:00 a.m. and 4:30 p.m. Workmen on the "day shift" shall receive eight (8) hours pay at the regular hourly rate for eight (8) hours work. The second shift (swing shift) shall be worked between the hours of 4:30 p.m. and 12:30 a.m. Workmen on the "swing shift" shall receive eight (8) hours pay at the regular hourly rate plus 10% for seven and one-half (7 ½) hours work. The third shift (graveyard shift) shall be worked between the hours of 12:30 a.m. and 8:00 a.m. Workmen on the "graveyard shift" shall receive eight (8) hours pay at the regular hourly rate plus 15% for seven (7) hours work. A lunch period of thirty (30) minutes shall be allowed on each shift. All overtime work required after the completion of a regular shift shall be paid at one and one-half (1½) times the "shift" hourly rate.

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NO. 48: Means the regularly scheduled work week shall be five (5) consecutive days, Monday through Friday or Tuesday through Saturday. Eight (8) hours shall constitute a day's work. Starting time shall not be earlier than 7:00 a.m. nor later than 10:00 a.m. Forty (40) hours shall constitute a week's work. Overtime at the rate of time and one-half (1½) will be paid for all work in excess of forty (40) hours in any one work week. On the Monday through Friday schedule, all work performed on Saturday will be time and one-half (1½) unless time has been lost during the week, in which case Saturday will be a make up day to the extent of the lost time. On the Tuesday through Saturday schedule, all work performed on Monday will be time and one-half (1½) unless time has been lost during the week, in which case Monday will be a make-up day to the extent of the lost time. Any work performed on Sunday will be double (2) time. If employees work on any of the recognized holidays, they shall be paid time and one-half (1½) their regular rate of pay for all hours worked.

NO. 50: Means eight (8) hours constitute a normal day's work Monday through Friday. Any time worked over eight (8) hours will normally be paid at time and one-half (1½) except for exclusions stated in some following additional sentences. The Employer, at his discretion, may start the work day between 6:00 a.m. and 9:00 a.m. Any schedule chosen shall be started at the beginning of the work week (Monday) and used for at least five days. Work may be scheduled on a four (4) days a week (Monday through Thursday) at ten (10) hours a day schedule. If such a schedule is employed, then Friday may be used as a make-up day when time is lost due to inclement weather. Time and one-half (1½) shall be paid for any work in excess of eight (8) hours in any regular work day Monday through Friday unless working 4-10's, then time and one-half (1½) after ten (10) hours. All work performed on Saturday will be time and one-half (1½). Double (2) time shall be paid for all work on Sundays and recognized holidays.

NO. 52: Means the regular workweek shall consist of five (5) eight (8) hour days, Monday through Friday. The regular workday shall consist of an eight (8) hour period, to be worked between the agreed upon starting time and ending no later than 4:30 p.m. The agreed upon starting time shall be any time between the hours of 6:00 a.m. and 8:00 a.m. The option exists for the employer to use a four (4) day, ten (10) hour work week. Days worked shall be Monday through Thursday or Tuesday through Friday. If the job requires men on duty all five (5) days, then part of the crew may work the first four (4) days and the remainder of the crew may work the last four (4) days. Hours each day shall be from 7:00 a.m. to 5:30 p.m. Interested parties on the project must agree to this clause before it may be used. Once this clause has been put into effect, it shall remain as long as the majority of the Employees on the project and the Employer agree to keep it. The four (4) day clause shall not be used to circumvent a Holiday. Except as otherwise provided, all work performed outside the regular working hours and performed during the regular work week (Monday through Friday) shall be at the following rates of pay:

Holidays-New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, Christmas Day (or days observed as such) shall be recognized as Holidays that shall be paid at two (2) times the regular rate of pay.

Labor Day-No work shall be performed on Labor Day except in special cases of emergency. Rate of pay shall be at three (3) times the regular rate of pay.

Overtime-Work performed outside of the regular work day (the regular work day shall consist of an eight (8) hour period, to be worked between the agreed upon starting time and ending not later than 4:30 p.m. The agreed upon starting time shall be any time between the hours of 6:00 a.m. and 8:00 a.m., by mutual consent of the interested party's.), shall be:

A. Hours worked Monday through Friday, the first two (2) hours of overtime will be paid at time and one-half (1½). All other overtime will be paid at the double (2) time rate.
B. The first ten (10) hours worked on Saturday will be paid at time and one-half (1½), with all other hours to be paid at the double (2) time rate.
C. Sundays and Holidays (except Labor Day) shall be paid at the double (2) time rate.

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NO. 57: Means eight (8) hours per day shall constitute a day's work and forty (40) hours per week, Monday through Friday, shall constitute a week's work. The regular starting time shall be 8:00 a.m. If a second or third shift is used, the regular starting time of the second shift shall be 4:30 p.m. and the regular starting period for the third shift shall be 12:30 a.m. These times may be adjusted by the employer. The day shift shall work a regular eight (8) hours shift as outlined above. Employees working a second shift shall receive an additional $0.25 above the regular hourly rate and perform seven and one-half (7½) hours work for eight (8) hours pay. Third shift employees shall be paid an additional $0.50 above the regular hourly rate and work seven (7) hours for eight (8) hours pay. When circumstances warrant, the Employer may change the regular workweek to four (4) ten-hour days at the regular time rate of pay. All time worked before and after the established workday of eight (8) hours, Monday through Friday, and all time worked on Saturday shall be paid at the rate of time and one-half (1½) except in cases where work is part of an employee's regular Friday shift. All time worked on Sunday and recognized holidays shall be paid at the double (2) time rate of pay except in cases where work is part of an employee's previous day's shift. For all overtime hours worked $26.71 of the fringe benefits portion of the prevailing wage shall be paid at the same overtime rate at which the cash portion of the prevailing wage is to be paid. The remaining $1.24 of the fringe benefit portion of the prevailing wage may be paid at straight time.

NO. 58: Means eight (8) consecutive hours, between 6:00 a.m. and 5:30 p.m., shall constitute a day's work. Five (5) days work, Monday through Friday, shall constitute a normal work week. Work performed in excess of eight (8) hours per day or eight hours beyond normal starting time for that project excluding lunch Monday through Friday, and all work performed on Saturday, shall be paid for the rate of time and one-half (1½). When Sundays and recognized holidays are worked, the worker(s) shall be paid at the rate of double (2) time. Work may be scheduled on a four (4) days a week (Monday through Thursday) at ten (10) hours a day schedule at straight time. A Friday make-up day is available if time is lost due to inclement weather and at least sixteen (16) hours, but not more than thirty (30) hours, were worked during the week.

NO. 63: Means eight (8) hours shall constitute the regular work day between time that may be advanced or delayed by two (2) hours on either side of 8:00 AM. The Employer may establish a work week consisting of four (4) days, Monday through Thursday, each day consisting of ten (10) hours straight time. The four (4) tens (10s) must run for a period of at least four (4) days, Monday through Thursday. All work on Friday on a four (4) tens (10) project will be paid at the rate of time and one-half (1½). All work performed on Saturday shall be paid at time and one-half (1½). All work performed on Sundays and recognized holidays must be paid at double (2) time. All work performed prior to or after the regular eight (8) hour work day, or ten (10) hour work day, as described above shall be paid at time and one-half (1½) the regular rate.

NO. 65: Means Monday through Sunday shall constitute the work week. Regular starting time shall be 8:00 a.m., with one half hour for lunch between three and one-half (3½) and five (5) hours after starting time. The starting time may be advanced by two (2) hours or delayed one (1) hour by the employer from the regular starting time. All work performed before the advanced starting time and during the half hour lunch shall be paid at the overtime rate of time and one-half (1½). Work performed outside these hours shall be paid at the overtime rate of time and one-half (1½), except as provided otherwise below. All work performed on Sundays or recognized holidays shall be paid at the double (2) time rate. When the start time is delayed past 9:00 a.m., the employee's pay shall start at 9:00 a.m. and all time, after the normal quitting time (5:30 p.m.), shall be paid at the overtime rate. Eight (8) hours shall constitute the work day. All work performed prior to or after the regular eight (8) hour work day, as described above, and all work performed on Saturday shall be paid at time and one-half (1½) the regular rate. In the event that a scheduled eight (8) hour work day is missed (not including recognized holidays) because of inclement weather, then that missed work day may be made up at straight time on the following Saturday. It is recognized that not all employees working on a Saturday make-up day will have worked the same number of hours during the regular work week. It is further recognized that any work after forty (40) hours must be paid at time and one-half (1½). The employer may establish a 4-10's schedule on projects (4 days with 10 hours per day at straight time). In order to use the 4-10's schedule, the employer must schedule the 4-10's for a minimum of one (1) week. If using a 4-10's schedule, a Friday make-up day is allowed.

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NO. 68: Means Monday through Sunday shall constitute the work week. Regular starting time shall be 8:00 a.m., with one half hour for lunch between three and one-half and five hours after starting time. The starting time may be advanced or delayed by the employer up to one hour from the regular starting time. All work performed before the advance starting time and during the half hour lunch shall be paid at the overtime rate of time and one-half (1½). Work performed outside these hours shall be paid at the overtime rate of time and one-half (1½), except as provided otherwise below. All work performed on Sundays or holidays shall be paid at the double (2) time rate. Eight (8) hours shall constitute the work day. All work performed prior to or after the regular eight (8) hour work day, as described above, and all work performed on Saturday shall be paid at time and one-half (1½) the regular rate, except as hereinafter described. In the event that a scheduled eight (8) hour work day is missed (not including recognized holidays) because of inclement weather, then that missed work day may be made up at straight time on the Saturday in the week of the pay period. It is recognized that not all employees working on a Saturday make-up day will have worked the same number of hours during the regular work week. It is further recognized that any work after forty (40) hours must be paid at time and one-half (1½). The employer may establish a 4-10's schedule on projects (4 days with 10 hours per day at straight time). In order to use the 4-10's schedule, the employer must schedule the 4-10's for a minimum of one (1) week. If using a 4-10's schedule, a Friday make-up day is allowed.

NO. 85: Means the work week shall be Monday through Sunday. Eight (8) hours shall constitute a day's work to begin between 6:00 a.m. and 9:00 a.m. and end between 2:30 p.m. to 5:30 p.m. Employees required to work during their lunch period shall receive the overtime rate. Employees shall receive time and one-half (1½) for all time they are required to work prior to their normal starting time or after eight (8) hours or normal quitting time Monday through Friday, or all day on Saturday. If an Employer has started the work week on a five day, eight hours a day schedule, and due to inclement weather misses any time, then he may switch to a nine or ten hours a day schedule, at straight time, for the remainder of that work week in order to make up for the lost time (10-hour make-up day). All work over ten (10) hours a day or over forty (40) hours a week must be paid at time & one-half (1½). Sundays and recognized holidays shall be paid at the double (2) time rate of pay. A contractor may alter the regular work week to four (4) ten (10) hour days at straight time rate of pay. To do this the scheduled 4-10's must be worked at least one full week and the regular workweek shall be Monday through Thursday with Friday being a make-up day at straight time for days missed in the regular workweek due to inclement weather. If 5-8's are being worked, Saturday may be used as a make-up day at straight time if inclement weather prevents work during the normal work week.

NO. 88: Means the regular work week shall consist of five (5) eight (8) hour days, 7:00 a.m. to 3:30 p.m., Monday through Friday, except when the work week is scheduled as a 4-10's week or as a week with start time advanced or delayed as described below. The starting time may be advanced or delayed by one hour on either side of 7:00 a.m. The advanced or delayed starting time must run for a period of at least five (5) days. The Employer may establish a work week consisting of four (4) days, during the regular work week, each day consisting of ten (10) hours at straight time. The 4-10's must run for a period of at least four (4) days. Time and one-half (1½) shall be paid for any work in excess of eight (8) hours in any regular work day Monday through Friday (or ten hours in a 4-10's week), the first eight (8) hours of a Saturday, and it shall be at time and one-half (1½) for the Friday and Saturday following Thanksgiving. Double (2) time shall be paid for the following time worked on Sunday, New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Dey, as well as any work in excess of eight (8) hours on a Saturday and the Saturday of a three-day weekend (except the Saturday following Thanksgiving).

NO. 95: Means a regular workday shall consist of eight and one-half (8½) hours elapsed time, including one-half hour for lunch. The crew starting times shall be flexible within the period of daylight to 8:00 a.m. Any work performed over ten (10) hours of elapsed time per day including one-half hour for lunch and/or any work performed over forty (40) hours at the straight time rate in one week shall be paid at time and one-half (1½) the straight time rate. Saturday shall be a voluntary make-up day at straight time at the discretion of the contractor and with the consent of the employees. Sunday and recognized holidays shall be paid for at double (2) time.

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BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 100: Means eight (8) hours shall constitute a day's work, and five (5) continuous eight-hour days shall constitute a week's work, Monday through Friday. Time and one-half (1½) the regular hourly rate shall be paid for all work performed in excess of eight (8) hours in any one day or forty (40) hours in any one week. Starting time shall be between 6:00 a.m. and 9:00 a.m. All work over eight (8) hours in a regular 5-day 8-hour schedule shall be at the appropriate overtime rate. All time worked before the regular scheduled starting time shall be paid for at the rate of time and one-half (1½) and shall not apply to regular shift. All time worked after eight (8) hours in any one day or after 5:30 p.m., whichever comes first, shall be paid at the time and one-half (1½) rate. An Employer, at his option, may elect to work four (4) ten (10) hour days, Monday through Thursday, at straight time. All such work must be done at least one week in duration. All work over ten (10) hours in one day or forty (40) hours in a week shall be at the overtime rate. Any employee who is scheduled to work on any regular work day but is prevented from working because of weather conditions, shall be permitted to work on Saturday (Friday if working 4-10's) as a make-up day at the straight time rate of pay. When an employee is required to work on any recognized holiday they shall receive the double (2) time rate for all time that they are required to perform work. All time worked from 12:00 Midnight Saturday to 12:00 Midnight Sunday shall be paid for at the rate of double (2) time on single shift.

NO. 125: Eight (8) hours of work between the hours of 8:00 a.m. and 4:30 p.m. shall constitute a work day. Forty (40) hours within the five (5) days, Monday through Friday inclusive, shall constitute the work week. Starting time may be adjusted not to exceed two (2) hours. Work performed outside of the aforamentioned will be paid at the applicable overtime rate. When starting time has been adjusted, all other provisions concerning the work day shall be adjusted accordingly. The overtime rate of pay shall be one and one-half (1½) times the regular rate of wages, other than on Sundays, holidays and from Midnight until 6:00 a.m., which will be paid at double (2) the straight time rate.

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HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 2: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, or the days observed as such, shall be paid at the double time rate of pay.

NO. 4: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas Day shall be paid at the double time rate of pay. If any of the above holidays fall on Sunday, Monday will be observed as the recognized holiday. If any of the above holidays fall on Saturday, Friday will be observed as the recognized holiday and holidays falling on Sunday will be observed on the following Monday.

NO. 7: The following days are assigned days and are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. If a holiday falls on a Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This is applied to protect Labor Day. When a holiday falls during the normal workweek, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week. However, no reimbursement for these eight (8) hours is to be paid to the workman unless worked. If workman are required to work the above enumerated holidays or days observed as such, or on Sunday, they shall receive double (2) the regular rate of pay for such work.

NO. 22: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day, or days locally observed as such, and Sunday shall be recognized as holidays. If a holiday falls on Saturday, Friday shall be observed; if it falls on Sunday, Monday shall be observed. All work performed on holidays shall be paid at the double (2) time rate of pay.

NO. 32: All work performed for the Friday and Saturday following Thanksgiving shall be paid at the time and one-half (1½) rate of pay. All work performed on Sundays, New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day shall be paid at the double (2) time rate of pay. When one of the above holidays falls on Sunday, the following Monday shall be observed and when one of the above holidays falls on Saturday, the preceding Friday shall be observed.

NO. 33: All work done on New Year's Day, Memorial Day, Fourth of July, Thanksgiving Day and Christmas Day shall be paid at the double time rate of pay. Labor Day shall be paid at the triple (3) time rate of pay. If the holiday falls on Sunday, the following Monday will be observed; if the holiday falls on Saturday, the preceding Friday will be observed.

NO. 39: No work shall be done on the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas. Any of these holidays falling on Sunday, the following Monday shall be a holiday, and any of these holidays falling on Saturday, the preceding Friday shall be a holiday.

NO. 49: The following days shall be observed as legal holidays: New Year's Day, Decoration Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day, Employee's birthday and two (2) personal days. The observance of one (1) of the personal days to be limited to the time between December 1 and March 1 of the following year. If any of these holidays fall on Sunday, the following Monday will be observed as the holiday and if any of these holidays fall on Saturday, the preceding Friday will be observed as the holiday. If employees work on any of these holidays they shall be paid time & one-half (1½) their regular rate of pay for all hours worked.

NO. 53: All work done on New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, Christmas Day or days observed as such for these holidays shall be paid at the double (2) time rate of pay. No work shall be performed on Labor Day except in special cases of emergency, and then the rate of pay shall be at three (3) times the regular rate of pay. When a holiday falls on a Sunday, the following Monday shall be observed as the holiday. When a holiday falls on Saturday, the preceding Friday shall be observed as the holiday.

NO. 54: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day shall be paid at the double (2) time rate of pay. When a holiday falls on Saturday, it shall be observed on Friday. When a holiday falls on Sunday, it shall be observed on Monday.

JACKSON COUNTY
HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 65: Work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. If the holiday falls on Saturday, it will be observed on Friday; if the holiday falls on Sunday, it will be observed on Monday, and shall be paid for at double (2) the regular straight time rate of pay.

NO. 67: All work performed on New Year's Day, Memorial Day, Christmas Day, Fourth of July and Thanksgiving Day, from midnight to midnight, shall be paid for at the rate of double time (2) the basic rate of pay if required to work in addition to any other pay otherwise required hereunder as holiday pay. Positively no work shall be performed on Labor Day. Martin Luther King's Birthday, Veteran's Day, and the day after Thanksgiving Day shall be considered optional holidays, and if the Employer and employees agree that work will be performed on that day, no premium pay will be required. Should any of the above holidays fall on Saturday, the holiday will be observed on Friday. Should any of the above holidays fall on Sunday, the holiday will be observed on Monday.

NO. 68: All work performed on New Year's Day, Decoration Day (Memorial Day), Independence Day (Fourth of July), Labor Day, Thanksgiving Day, Christmas Day, or days observed as such, shall be paid at the rate of double (2) time. When a holiday falls on a Saturday, Friday shall be observed. When a holiday falls on a Sunday, Monday shall be observed. No work shall be performed on the Fourth of July or Labor Day except to save life or property. Where one of the holidays specified falls or is observed during the work week, then all work performed over and above thirty-two (32) hours in that week shall be paid at the rate of time and one-half (1½).

NO. 72: All work performed on New Year's Day, Memorial Day (last Monday in May), Independence Day, Labor Day, Thanksgiving Day and Christmas Day shall be paid for at double (2) the regular straight time rate of pay. Any one of the above listed holidays falling on Sunday shall be observed on the following Monday and paid for at double (2) the regular straight time rate of pay, if worked. Any one of the above listed holidays falling on Saturday shall be observed on the prior Friday and paid for at double (2) the regular straight time rate of pay, if worked. No work shall be performed on Labor Day except in case of emergency.

OCCUPATIONAL TITLE	* Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Carpenter	6/16	$37.25	1	17	$16.10
Cement Mason		$31.12	3	2	$16.20
Electrician (Outside-Line Construction\Lineman)		$41.52	18	24	$5.00 + 34.5%
Lineman Operator		$38.37	18	24	$5.00 + 34.5%
Lineman - Tree Trimmer		$21.64	31	30	$5.00 + 27.5%
Groundman		$26.76	18	24	$5.00 + 34.5%
Groundman - Tree Trimmer		$17.50	31	30	$5.00 + 27.5%
Laborer					
General Laborer	6/16	$29.14	3	2	$14.77
Skilled Laborer	6/16	$30.35	3	2	$14.77
Millwright	6/16	$37.25	1	17	$16.10
Operating Engineer					
Group I	6/16	$35.82	3	2	$15.99
Group II	6/16	$34.78	3	2	$15.99
Group III	6/16	$34.78	3	2	$15.99
Group IV	6/16	$30.31	3	2	$15.99
Oiler-Driver	6/16	$33.66	3	2	$15.99
Pile Driver	6/16	$37.25	1	17	$16.10
Traffic Control Service Driver		$28.54	FED		$14.57
Truck Driver-Teamster					
Group I	6/16	$30.89	3	2	$14.45
Group II	6/16	$30.89	3	2	$14.45
Group III	6/16	$30.89	3	2	$14.45
Group IV	6/16	$30.89	3	2	$14.45

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate sheet.

JACKSON COUNTY
OVERTIME SCHEDULE - HEAVY CONSTRUCTION

FEO: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 1: Means (8) hours shall constitute the regular work day between time that may be advanced or delayed by two (2) hours on either side of 8:00 AM. The Employer may establish a work week consisting of four (4) days, Monday through Thursday, each day consisting of ten (10) hours straight time. The four (4) tens (10s) must run for a period of at least four (4) days, Monday through Thursday. All work on Friday on a four (4) tens (10) project will be paid at the rate of time and one-half (1½). All work performed on Saturday shall be paid at time and one-half (1½). All work performed on Sundays and recognized holidays must be paid at double (2) time. All work performed prior to or after the regular eight (8) hour work day, or ten (10) hour work day, as described above shall be paid at time and one-half (1½) the regular rate.

NO. 3: Means a regular work week shall consist of not more than forty (40) hours of work and all work performed over and above ten (10) hours per day or forty (40) hours per week shall be paid at the rate of time & one-half (1½). Workers shall receive time and one-half (1½) for all work performed on Sundays and recognized holidays. Double (2) time shall be paid for work performed on Sundays or recognized holidays when and only if any other craft employees of the same employer at work on that same job site are receiving double (2) time pay for that Sunday or Holiday work. A work day is to begin between 6:00 a.m. and 9:00 a.m. at the option of the Employer except when inclement weather or other conditions beyond the reasonable control of the Employer prevents work, in which event, the starting time may be delayed, but not later than 12:00 noon. Where one of the recognized holidays falls or is observed during the work week, then all work performed over and above thirty-two (32) hours in that week shall be paid at the rate of time and one-half (1½).

NO: 18: Eight (8) hours of work between the hours of 8:00 a.m. and 4:30 p.m. shall constitute a work day. Forty (40) hours within the five (5) days, Monday through Friday inclusive, shall constitute the work week. Starting time may be adjusted not to exceed two (2) hours. Work performed outside of the aforementioned will be paid at the applicable overtime rate. When starting time has been adjusted, all other provisions concerning the work day shall be adjusted accordingly. The overtime rate of pay shall be one and one-half (1½) times the regular rate of wages, other than on Sundays, holidays and from Midnight until 6:00 a.m., which will be paid at double (2) the straight time rate.

NO. 31: Means the overtime rate shall be time and one-half the regular rate for work over forty (40) hours per week. Sundays and Holidays shall be paid at double the straight time rate. All employees performing work on affected properties during or following emergencies shall receive the applicable rate of pay for the first sixteen (16) consecutive hours and all hours worked in excess of sixteen (16) consecutive hours shall be paid at double time until broken by an eight (8) hour rest period. Should an employee be called back to work within two hours of his normal quitting time, the previous hours worked shall count toward the above sixteen (16) hour provision.

JACKSON COUNTY
HOLIDAY SCHEDULE – HEAVY CONSTRUCTION

NO. 2: All work performed on New Year's Day, Decoration Day (Memorial Day), Independence Day (Fourth of July), Labor Day, Thanksgiving Day and Christmas Day, or days observed as such, and Sundays shall be paid at the rate of time and one-half (1½). Double (2) time shall be paid for work on Sundays or recognized holidays when and only if other craft employees of the same employer at work on that same job site are receiving double (2) time pay for that Sunday or holiday work. No work shall be performed on Labor Day, except in case of jeopardy of life or property. This rule is applied to protect Labor Day. When one of the above holidays falls on a Saturday, the preceding Friday shall be observed; when the holiday falls on a Sunday, the following Monday shall be observed. Where one of the specified holidays falls or is observed during the work week, then all work performed over and above thirty-two (32) hours in that week shall be paid at the rate of time and one-half (1½).

NO. 17: All work performed on New Year's Day, Decoration Day (Memorial Day), Independence Day (Fourth of July), Labor Day, Thanksgiving Day, Christmas Day, or days observed as such, shall be paid at the rate of double (2) time. When a holiday falls on a Saturday, Friday shall be observed. When a holiday falls on a Sunday, Monday shall be observed. No work shall be performed on the Fourth of July or Labor Day except to save life or property. Where one of the holidays specified falls or is observed during the work week, then all work performed over and above thirty-two (32) hours in that week shall be paid at the rate of time and one-half (1½).

NO. 24: Work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. If the holiday falls on Saturday, it will be observed on Friday; if the holiday falls on Sunday, it will be observed on Monday, and shall be paid for at double (2) the regular straight time rate of pay.

NO. 30: All work performed on New Year's Day, Decoration Day, Fourth of July, Labor Day, Christmas Day, Thanksgiving Day and Day after Thanksgiving or days celebrated for the same.

DIVISION OF LABOR STANDARDS

MISSOURI DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

PREVAILING WAGE PROJECT NOTIFICATION – CONTRACTOR INFORMATION

The information below is requested pursuant to Sections 290.210 through 290.340 and 290.550 through 290.580, RSMo. During a time of excessive unemployment, only Missouri laborers and laborers from non-restrictive states shall be employed on public works projects. See 290.550 through 290.580, RSMo.

1. Date of Notification	2. Annual Wage Order Number Included in Bid Specifications
3. Popular or Descriptive Name of Project	
4. Estimated Project Cost of Completion *(total construction contracts to be awarded)* $	
5. Exact Location of Project County City Township	
6. Official Name of Public Body or Agency	
7. Name of Contact Person	8. Phone Number *(include area code)*
9. Address	
10. E-mail Address Website	
11. Anticipated Date for Soliciting or Advertising for Bids	12. Contract Award Date
13. Estimated Start Date of Work / 14. Estimated Date of Project Completion	15. Will There Be Any Federal Funds Used in this Contract? ☐ Yes ☐ No

16. Contractor Information Notification

General Contractor:

Name _____

Address _____

City _____ State _____ ZIP _____

Phone Number _____ E-mail Address _____

Type of Craftsmen Needed by Project _____

Scope of Work _____

List all Subcontractors:

Name _____

Address _____

City _____ State _____ ZIP _____

Phone Number _____ E-mail Address _____

Type of Craftsmen Needed by Project _____

Scope of Work _____

Name _____

Address _____

City _____ State _____ ZIP _____

Phone Number _____ E-mail Address _____

Type of Craftsmen Needed by Project _____

Scope of Work _____

The state of Missouri requires workers on public works projects be paid the prevailing wage. Public bodies have duties as required under this law (Section 290.210 - 290.340, RSMo).

Mail, Fax or E-mail completed form to: DIVISION OF LABOR STANDARDS
Attn: Prevailing Wage Section
P.O. Box 449 Jefferson City, MO 65102-0449

Phone: 573-751-3403 Fax: 573-751-3721 E-mail: prevailingwage@labor.mo.gov Website: www.labor.mo.gov/DLS

DIVISION OF LABOR STANDARDS

MISSOURI DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
DIVISION OF LABOR STANDARDS

AFFIDAVIT
COMPLIANCE WITH THE PREVAILING WAGE LAW

I, _____, upon being duly sworn upon my oath state that: (1) I am the
(Name)

_____ of _____; (2) all requirements of
(Title) *(Name of Company)*

§§ 290.210 to 290.340, RSMo, pertaining to the payment of wages to workers employed on public works projects have been fully satisfied with regard to this company's work on _____;
(Name of Project)

(3) I have reviewed and am familiar with the prevailing wage rules in 8 CSR 30-3.010 to 8 CSR 30-3.060; (4) based upon my knowledge of these rules, including the occupational titles set out in 8 CSR 30-3.060, I have completed full and accurate records clearly indicating (a) the names, occupations, and crafts of every worker employed by this company in connection with this project together with an accurate record of the number of hours worked by each worker and the actual wages paid for each class or type of work performed, (b) the payroll deductions that have been made for each worker, and (c) the amounts paid to provide fringe benefits, if any, for each worker; (5) the amounts paid to provide fringe benefits, if any, were irrevocably paid to a trustee or to a third party pursuant to a fund, plan, or program on behalf of the workers; (6) these payroll records are kept and have been provided for inspection to the authorized representative of the contracting public body and will be available, as often as may be necessary, to such body and the Missouri Department of Labor and Industrial Relations; (7) such records shall not be destroyed or removed from the state for one year following the completion of this company's work on this project; (8) when in effect, the requirements of §§ 290.550 through 290.580, RSMo, pertaining to excessive unemployment were fully satisfied; and (9) there has been no exception to the full and complete compliance with the provisions and requirements of Annual Wage Order No. _____ Section _____ issued by the Missouri Division of Labor Standards and applicable to this project located in _____ County, Missouri, and completed on the _____ day of _____, _____.

The matters stated herein are true to the best of my information, knowledge, and belief. I acknowledge that the falsification of any information set out above may subject me to criminal prosecution pursuant to §§290.340, 570.090, 575.040, 575.050, or 575.060, RSMo.

_____
Signature

Subscribed and sworn to me this _____ day of _____, _____.

My commission expires _____, _____.

_____
Notary Public

_____
Receipt by Authorized Public Representative

DIVISION OF LABOR STANDARDS

MISSOURI DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
DIVISION OF LABOR STANDARDS

REQUEST FOR WAGE DETERMINATION

PLEASE RETURN TO: Division of Labor Standards
Attn: Prevailing Wage Section
P.O. Box 449
Jefferson City, MO 65102-0449

Phone: 573-751-3403
Fax: 573-751-3721
E-mail: prevailingwage@labor.mo.gov
Website: www.labor.mo.gov/DLS

REQUESTER INFORMATION

I am requesting a wage determination according to Chapter 290 of the Missouri Prevailing Wage Law (sections 290.210 through 290.340 and 290.550 through 290.580 RSMo).

Name of Requester *(please print)*	Requester's Title	
Requester's Organization		Phone Number *(include Area Code)*
Mailing Address		E-mail Address
City	State	ZIP Code

PUBLIC BODY INFORMATION

Contact Person at Public Body		
Official Name of the Public Body requesting the wage rates		Phone Number *(include Area Code)*
Street Address		E-mail Address
City	State	ZIP Code

FUNDING INFORMATION

Will the federal government or any of its agencies furnish loans or grants for any part of the funds used in your contracts?

☐ Yes ☐ No

If "Yes," will the federal government or any of its agencies also prescribe a schedule of Prevailing Wage Rates?

☐ Yes ☐ No

COUNTY(IES) REQUESTED

Please list county(ies) requested: _____

(for St. Louis, please specify "County" or "City")

ANNUAL WAGE ORDER PASSWORDS

The Annual Wage Order is being provided to requesters via the Division's website. Passwords are required to access the Annual Wage Order and Incremental Increases on the Internet. Please provide an e-mail address below where we can send a password to you.

E-mail address: _____

_____ / / _____

Requester's Signature Date of Request

DOCUMENT 008400 - ATTACHMENTS

1.1 APPLICABLE AFFIDAVITS AND FORMS

A. The electronic verification of work authorization, "E-Verify" form is bound hereinafter for Contractor's duplications and use.

B. The OSHA "Affidavit of 10 Hour OSHA Training" is bound hereinafter for Contractor's duplication and use.

C. "Contractor's Affidavit Concerning Drug/Alcohol Testing Program" form is bound hereinafter for Contractor's duplication and use.

D. The "Missouri Service-Disabled Veteran Business Preference" form is bound hereinafter for Contractor's duplication and use.

END OF DOCUMENT 008400

FEDERAL WORK AUTHORIZATION PROGRAM AFFIDAVIT

I, _____, being of legal age and having been duly sworn upon my oath, state the following facts are true:

1. I am more than twenty-one years of age; and have first-hand knowledge of the matters set forth herein.

2. I am employed by _____ (hereinafter "Company") and have authority to issue this affidavit on its behalf.

3. Company is enrolled in and participating in the United States E-Verify (formerly known as "Basic Pilot") federal work authorization program with respect to Company's employees working in connection with the services Company is providing to, or will provide to, the District, to the extent allowed by E-Verify.

4. Company does not knowingly employ any person who is an unauthorized alien in connection with the services the Company is providing to, or will provide to, the District.

FURTHER AFFIANT SAYETH NOT.

By: _____ (individual signature)

For: _____ (company name)

Title: _____

Subscribed and sworn to before me on this _____ day of _____, 20___.

_____
NOTARY PUBLIC

My commission expires:

FEDERAL WORK AUTHORIZATION PROGRAM ("E-VERIFY") ADDENDUM

Pursuant to Missouri Revised Statute 285.530, all business entities awarded any contract in excess of five thousand dollars ($5,000) with a Missouri public school district must, as a condition to the award of any such contract, be enrolled and participate in a federal work authorization program with respect to the employees working in connection with the contracted services being provided, or to be provided, to the District (to the extent allowed by E-Verify). In addition, the business entity must affirm the same through sworn affidavit and provision of documentation. In addition, the business entity must sign an affidavit that it does not knowingly employ any person who is an unauthorized alien in connection with the services being provided, or to be provided, to the District.

Accordingly, your company:

A. agrees to have an authorized person execute the attached "Federal Work Authorization Program Affidavit" attached hereto as Exhibit A and deliver the same to the District prior to or contemporaneously with the execution of its contract with the District;

B. affirms it is enrolled in the "E-Verify" (formerly known as "Basic Pilot") work authorization program of the United States, and are participating in E-Verify with respect to your employees working in connection with the services being provided (to the extent allowed by E-Verify), or to be provided, by your company to the District;

C. affirms that it is not knowingly employing any person who is an unauthorized alien in connection with the services being provided, or to be provided, by your company to the District;

D. affirms you will notify the District if you cease participation in E-Verify, or if there is any action, claim or complaint made against you alleging any violation of Missouri Revised Statute 285.530, or any regulations issued thereto;

E. agrees to provide documentation of your participation in E-Verify to the District prior to or contemporaneously with the execution of its contract with the District (or at any time thereafter upon request by the District), by providing to the District an E-Verify screen print-out (or equivalent documentation) confirming your participation in E-Verify;

F. agrees to comply with any state or federal regulations or rules that may be issued subsequent to this addendum that relate to Missouri Revised Statute 285.530; and

G. agrees that any failure by your company to abide by the requirements a) through f) above will be considered a material breach of your contract with the District.

By:_____ (signature)

Printed Name and Title: _____

For and on behalf of: _____ (company name)

AFFIDAVIT OF 10 HOUR OSHA TRAINING

Comes now _____ as _____ first
Name Office Held

being duly sworn, on my oath, affirm _____ does
Company Name

comply with the requirements of Section 292.675, which requires all contractors and subcontractors doing work on the project to provide, and require its on-site employees to complete a ten-hour course in construction safety and health approved by the Occupational Safety and Health Administration (OSHA) or a similar program approved by the Missouri Department of Industrial Relations which is at least as stringent as an approve OSHA program.

In Affirmation thereof, the facts stated above are true and correct (The undersigned understands that false statements made in this filing are subject to the penalties provided under Section 292.675, RSMo).

_____ _____
Signature (person with authority) Printed Name

_____ _____
Title Date

Subscribed and sworn to before me this _____ of _____, 20___.

_____ _____
Signature of notary Date

Contractor's Affidavit Concerning Drug/Alcohol Testing Program

STATE OF MISSOURI)
) ss
COUNTY OF)

COMES NOW the Affiant after having first been duly sworn and testifies as follows:

My name is _____. I hold the principal office of _____ for _____. I, the undersigned, being duly sworn, certify that _____ is in compliance with the provisions of Missouri Revised Statute § 161.371; that _____ has established and implemented a random drug and alcohol testing program as required by Missouri Revised Statute § 161.371 and any applicable regulations. I further certify that _____ shall subcontract work only to subcontractors meeting the requirements of Missouri Revised Statute § 161.371.

_____
Name of Contractor

_____
Address

_____
City

_____
State

By:_____

Subscribed and sworn to before me this ___ day of _____20__.

_____
Notary Public

My Commission Expires:

Print Form

MISSOURI SERVICE-DISABLED VETERAN BUSINESS PREFERENCE

Pursuant to section 34.074, RSMo, a preference will be given all contracts for the performance of any job or service to service-disabled veteran business either doing business as Missouri firms, corporations, or individuals; or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less or whenever competing bids, in their entirety, are comparable.

Definitions:

Service-Disabled Veteran is defined as any individual who is disabled as certified by the appropriate federal agency responsible for the administration of veterans' affairs.

Service-Disabled Veteran Business is defined as a business concern:

a. Not less than fifty-one (51) percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than fifty-one (51) percent of the stock of which is owned by one or more service-disabled veterans; and
b. The management and daily business operations of which are controlled by one or more service-disabled veterans.

If a bidder meets the definitions of a service-disabled veteran and a service-disabled veteran business as defined in section 34.074, RSMo, and is either doing business as a Missouri firm, corporation, or individual; or maintains a Missouri office or place of business, the bidder **must** provide the following with the proposal in order to receive the Missouri service-disabled veteran business preference over a non-Missouri service-disabled veteran business when the quality of performance promised is equal or better and the price quoted is the same or less or whenever competing proposals, in their entirety, are comparable:

a. A copy of a letter from the Department of Veterans Affairs (VA), or a copy of the bidder's discharge paper (DD Form 214, Certificate of Release or Discharge from Active Duty) from the branch of service the bidder was in; and
b. A completed copy of this exhibit

(NOTE: For ease of evaluation, please attach copy of the above-referenced letter from the VA or a copy of the bidder's discharge paper to this Exhibit. The above-referenced letter from the VA and a copy of the bidder's discharge paper shall be considered confidential pursuant to subsection 14 of section 610.021, RSMo.)

By signing below, I certify that I meet the definitions of a service-disabled veteran and a service-disabled veteran business as defined in 34.074 RSMo and that I am either doing business as a Missouri firm, corporation, or individual; or maintain Missouri offices or places of business at the location(s) listed below.

_____	_____
Service-Disabled Veteran's Name (Please Print)	Service Disabled Veteran Business Name
	_____
	_____
_____	_____
Service-Disabled Veteran's Signature	Missouri Address of Service-Disabled Veteran Business

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Access to site.
   4. Work restrictions.
   5. Specification and drawing conventions.
   6. Miscellaneous provisions.

B. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Independence School District – Central Warehouse.
   1. Project Location: 14001 East 32nd Street, Independence, Missouri 64055

B. Owner: Independence School District, 201 N. Forest Avenue, Independence, Missouri 64050.
   1. Owner's Representative: Robert Burkey, Director of Facilities.

C. Architect: Hollis + Miller Architects, 220 NW Executive Way, Lee's Summit, Missouri 64063.
   1. Architect Representative: Grant Thome Phone: 816.525.5900.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. Work consists of, but is not limited to, limited selective demolition, sitework, architectural, mechanical, electrical, plumbing and technology work as indicated in the Contract Documents. Refer to Drawings for code classifications, occupancy and construction types.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Anticipated Construction Start Dates:
   1. Central Warehouse: After award of contract and issuance of notice to proceed. Estimated date of Notice to Proceed is August 11, 2016.

C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Driveways, Walkways and Entrances: Keep driveways, loading areas, entrances serving premises clear and available to Owner, Owner's employees, 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 by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated.
   1. Weekend Hours: Same as for weekdays.
   2. Contractors may work second shift, if desired by Contractor.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Architect and Owner not less than four days in advance of proposed utility interruptions.
   2. Obtain Architect's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Architect and Owner not less than 72 hours in advance of proposed disruptive operations.
   2. Obtain Architect's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted on School property.

F. Controlled Substances: Use of tobacco products and other controlled substances is not permitted on School property.

G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into 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 award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Omit Painting (Selected Areas).
   1. Alternate: Omit painting at walls and ceilings at Food Storage 1, Food Storage 2, Storage Bay 1, Storage Bay 2, and Storage Bay 3 as indicated on Room Finish Schedule on Sheet A002 accordance with Contract Documents.
   2. Base Bid: Provide all finished as noted on Room Finish Schedule.

B. Alternate No. 2: Paint Building Exterior.
   1. Alternate: Provide labor and material for surface preparation and painting of all exterior building surface, including but not limited to EIFS, Metal Panels, and CMU in accordance with Contract Documents. All new prefinished metal gutters and downspouts shall not be painted and shall be protected during construction.
   2. Base Bid: Existing Exterior surfaces shall remain without painting.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for “Substitutions for Convenience” and “Substitutions for Cause”.

B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
   2. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by the Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms. Substitutions for Cause shall be submitted after award of the contract as set forth hereinafter.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner. Substitutions for Convenience shall be submitted prior to bidding as set forth hereinafter.

B. Comparable Products: Naming of specified items on the Drawings and in the specifications, means that such named items are specifically required by the Architect and/or Owner. When the words “or comparable product” follows such named item(s), a substitution request must be submitted when proposing a product other than the named product. Requests for substitutions must be received by the Architect within the time frame set hereinafter.

C. The following are not considered substitutions:
   1. Revisions to Contract Documents requested by the Owner or Architect.
   2. Specified options of products, materials and construction methods included in the Contract Documents.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit at least one (1) paper copy or an electronic pdf copy of each substitution request for consideration to the Architect. Clearly Identify proposed product and related options or fabrication or installation method to be replaced. Include Specification Section number and title, in addition to applicable Drawing numbers and titles.
   1. Substitution Request Form: Use facsimile of form provided at the end of this Section.
      a. Accompanying each Substitution Request shall be a fully executed copy of the Substitution Request Form.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed and direct comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Specifically indicate deviations, if any, from the Work specified in writing.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested, of proposed substitution and of specified product shall be submitted for comparison and review by Architect.
      f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names, addresses and contact information of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Review Process: Submittal requests for proposed substitutions will be processed using the following procedures:
   a. Submittals will be "Received Dated" immediately upon arrival.
   b. Submittals will be placed by receiving person in a file designated for that purpose.
   c. Submittals will not be reviewed for completeness or compliance until after the date and time established for closing of receipt of substitution request submittals.
   d. Submittals will be reviewed by a member of Hollis + Miller Architect's staff (or respective consultant). Reviewer(s) will not be designated until after closing period established for receipt of submittals.
   e. Reviewer's General Attitude will be:
      1) Burden of Proof is on Proposer.
      2) Reviewer should not be required to complete the submittal, that is, select from options or between models and lines of products.
      3) Reviewer should not be required to conduct an exhaustive review of the submittal. Submittals of manufacturer's catalogs which do not clearly indicate proposed product and proposed product options will be rejected.
      4) Reviewer should not be required to seek information from manufacturer's literature on file in the office, from an improperly submitted electronic submittal or information in other locations.
      5) Substitute must be "comparable to" or superior in those features and performance which the Project requires and those which the specified product will provide.
      6) Review is complete when, in the reviewer's opinion, significant deficiency(ies) are established. In such case, review of data covering other points of specifications is not required.
   f. Reviewer will note action taken (No Exception taken to Submitted Manufacturer, No Exception taken to Specific Product, Exceptions Noted, Not Accepted or Received Late), the date, and his/her initials.
   g. All submittals received after closing time will be "Received Dated", marked "Late", initialed by reviewer, and filed without review.
   h. Submittals will be filed in Architect's office until completion of the Project.
4. Architect's Action:
   a. Architect will review requests for "Substitutions for Convenience" only once, no additional information may be submitted. Architect may request additional information as necessary for review of "Substitutions for Cause."
   b. Architect will note action taken.
   c. Architect is not obligated nor required to review any and all substitution requests.
   d. Architect is not obligated to inform proposers of substitutions of incomplete and non-accepted requests for substitution.
   e. Acceptance of Substitutions:
      1) Acceptance of Substitutions for Convenience: Accepted substitutions will be set forth in an Addendum and in no other manner.
         a) Use product specified if Architect does not issue a decision on use of a proposed substitution.
      2) Acceptance of Substitutions for Cause: Architect will review proposed substitution within 15 business days of receipt of request. If necessary, Architect will request additional information or documentation for evaluation within seven (7) business days of receipt of a request for Substitution for Cause." Only acceptable substitutions will receive notification of status.

Substitutions shall be considered unacceptable unless a form of acceptance is received by the Proposer.

a) Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b) Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 ELECTRONIC SUBMITTAL OF SUBSTITUTIONS

A. Substitution Request submittals will be accepted for review when submitted electronically under the following conditions. Substitution requests which are not submitted in accordance with the criteria listed below may be rejected at the Architect's discretion.
   1. Accompanying each submittal shall be a fully executed copy of the Substitution Request Form.
   2. Submittals sent to Hollis + Miller Architects, shall be sent to **jdurham@hollisandmiller.com**. Submittals directed to the attention of anyone other than **Justin Durham** will not be considered.
   3. Submittals of Substitutions for Cause must be received within the time limits set forth in Paragraph 2.1 A of this Section.
   4. Submittals of Substitutions for Convenience must be received prior to bidding and within the time limits set forth in Paragraph 2.1 B of this Section.
   5. Documentation requirements as set forth in 1.3 A.2a through 1.3 A.2m are applicable to electronic submittals.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than thirty (30) days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect and Owner will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Request is directly related to a "or comparable product" clause or similar language in the Contract Documents.
      c. Specified product or method of construction cannot be provided within the Contract Time.
      d. Specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
      e. Specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution will provide the specified warranty.
      f. Substitution request is fully documented and properly submitted.
      g. Requested substitution will not adversely affect Contractor's construction schedule.
      h. Requested substitution has received necessary approvals of authorities having jurisdiction.
      i. Requested substitution is compatible with other portions of the Work.
      j. Requested substitution has been coordinated with other portions of the Work.
      k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution only when submitted no later than eight (8) days prior to the date established for the receipt of bids, and no later than 4:00 p.m. (local time). Requests received after that time may be considered or rejected at discretion of Architect.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's construction schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.
      g. Requested substitution is compatible with other portions of the Work.
      h. Requested substitution has been coordinated with other portions of the Work.
      i. Requested substitution provides specified warranty.
      j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. The Contractor’s submittal and A/E’s acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptance or validate request for substitution, nor does it constitute approval.

D. Under no circumstances does the Architect’s and/or Owner’s acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the Work.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SUBSTITUTION REQUEST FORM

MAIL TO: Hollis + Miller Architects
8205 W. 108th Terrace, Suite 200
Overland Park, Kansas 66210

PROJECTS: Independence School District
Central Warehouse

SPECIFIED ITEM:_____

PROPOSED SUBSTITUTE:_____

SUBMITTED BY:

Firm: _____

Address:_____

Signature:_____

Date: _____ Phone No. _____ Fax No._____

Attach complete description, designation, catalog or model number, Spec Data Sheet and other Technical Data and samples, including Laboratory Tests if Applicable.

Fill in blanks below:

1. Will substitution affect dimension indicated on drawings? _____
   _____
2. Will substitution affect wiring, piping, ductwork, etc., indicated on drawings? _____
   _____
3. What effect will substitution have on other trades? _____
   _____
4. Differences between proposed substitution and specified item? _____
   _____
5. Any and all impacts on costs, design modifications, additional architectural and engineering services, material and labor changes, schedule changes, and other unanticipated consequences, resulting from this substitution in lieu of the specified item, shall be the full responsibility of the contractor and his subcontractors and supplier.
6. Manufacturer's warranties of the specified items and proposed items are: [ ] same [ ] different, *explain:*
   _____

REVIEW COMMENTS:

[ ] **No Exception taken to Submitted Manufacturer**
Manufacturer only is accepted due to time limitations for full review of product, or because no specific product data is submitted, or other unspecified reasons. Contractor must still bear full responsibility for compliance with contract requirements.

[ ] **No Exception taken to Specific Products**

[ ] **Exceptions Noted**
See attached copy or notes on product literature

[ ] **Not Accepted**

[ ] **Received too Late**

By:_____ Date:_____

Remarks:_____

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:
   1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining 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 the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   7. Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
   6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
   8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
      a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Submit Application for Payment to Architect by the first day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month. The Owner will make payments to the Contractor within thirty days of receipt of certified payment application from Architect. When applications for payment are received by the Architect after the first day of the month, payment will be made in the next payment cycle.
   1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit executed waivers of lien on forms, included in the Project Manual.

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

2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final liquidated damages settlement statement.
   10. Copy of the Affidavit of Compliance with Prevailing Wage Determination sent to the State.
   11. Asbestos-Free and Lead-Free Certification Letter in form acceptable to Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Requests for Information (RFIs).
   3. Project meetings.

B. Related Requirements:
   1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly in form acceptable to Architect. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.6 PROJECT MEETINGS

A. General: Contractor will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Contractor will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Parking availability.
    u. Office, work, and storage areas.
    v. Equipment deliveries and priorities.
    w. First aid and Security.

x. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: 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 Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Contractor will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of record documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Submittal of written warranties.
   d. Requirements for preparing operations and maintenance data.
   e. Requirements for delivery of material samples, attic stock, and spare parts.
   f. Requirements for demonstration and training.
   g. Preparation of Contractor's punch list.
   h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   i. Submittal procedures.
   j. Owner's partial occupancy requirements.
   k. Installation of Owner's furniture, fixtures, and equipment.
   l. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Contractor will conduct progress meetings at weekly intervals.
   1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.
         5) Off-site fabrication.
         6) Access.
         7) Site utilization.
         8) Temporary facilities and controls.
         9) Progress cleaning.
         10) Quality and work standards.
         11) Status of correction of deficient items.
         12) Field observations.
         13) Status of RFIs.
         14) Status of proposal requests.
         15) Pending changes.
         16) Status of Change Orders.
         17) Pending claims and disputes.
         18) Documentation of information for payment requests.
   3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
      a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's construction schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Special reports.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
   2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 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 Activity: An activity on the critical path that 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.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. Construction Schedule Updating Reports: Submit at weekly intervals.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at weekly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

H. Special Reports: Submit at time of unusual event.
   1. Adverse Weather Days: Document conditions effecting construction activities and submit within 24 hours of the event.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 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 main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 15 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 30 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 Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
   4. Startup and Testing Time: Include no fewer than 10 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.
   6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final 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. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   3. 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.
   4. 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.

5. Construction Areas: 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. Temporary enclosure and space conditioning.
   c. Permanent space enclosure.
   d. Completion of mechanical installation.
   e. Completion of electrical installation.
   f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion and the following interim milestones:
   1. Temporary enclosure and space conditioning.

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 012900 "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 seven 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.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within fourteen days of date established for the Notice to Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

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 seven days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information 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 three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 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. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.

5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule two 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 final 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 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:
1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect, and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. It is expected that all submittals will be submitted within the durations outlined in the bid form as provided by each trade.
      a. A $100.00 per calendar day penalty will be assessed for any submittal received after durations received as provided by each trade. The penalty will be deducted from the contract through deductive change order. Only if written authorization from the Owner through the Architect to extend this time frame can this "per day" penalty not be enforced.
      b. The completion time of the contract will not be extended for delays caused by tardiness of submittals. Cost of such delays shall not be borne by the Owner and may be back-charged as necessary.
         1) Contractor shall assume full responsibility for providing materials as specified at their risk to maintain schedule if submittals are not submitted within durations provided on the bid form.
      c. Upon receipt of unapproved submittals, Contractor shall have seven (7) calendar days to revise and resubmit. After such time, the penalty outlined above in 1.4 C.1.a will be assessed.
   2. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   4. Resubmittal Review: Allow 7 days for review of each resubmittal.
   5. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
   6. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect, before being returned to Contractor.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., ISD-079200.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., ISD-079200.01.A).
      b. Specific material/product identifier: After listing the project identifier and section number as described above, clearly indicate the material/product submitted corresponding to specific paragraph in the specification (e.g., Silicone Joint Sealant – 2.2 A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
   4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner**,** containing the following information:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name of Contractor.
      e. Name of firm or entity that prepared submittal.
      f. Names of subcontractor, manufacturer, and supplier.
      g. Category and type of submittal.
      h. Submittal purpose and description.

i. Specification Section number and title.
j. Specification paragraph number or drawing designation and generic name for each of multiple items.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number, numbered consecutively.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

D. Options: Clearly identify options requiring selection by Architect.

E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Post electronic submittals as PDF electronic files directly to the Project file on KC Blueprint's website established for Project.
   a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to clearly show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.

d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples and Shop Drawings, as applicable.
6. Submit Product Data in the following format:
   a. PDF electronic file according to Paragraph 2.1 A.1.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
   a. PDF electronic file according to Paragraph 2.1 A.1.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Sample for “initial selection” shall be listed as a separate item in the submittal schedule.
   b. Number of Samples: Unless specifically required otherwise in Specification Section, submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
   1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
   2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file in addition to three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action as follows:
   1. No Exception Taken: Signifies item represented in the submittal conforms with the design intent, complies with the intent of the Contract Documents and is acceptable for incorporation into the Work. Contractor is to proceed with fabrication or procurement and related work.
   2. Exceptions Noted: Signifies item represented in the submittal conforms with the design concept, complies with the intent of the Contract Documents and is recommended for incorporation into the Work in accordance with the Architect's and/or Consultant's notations. Contractor is to proceed with the work in accordance the Architect's and/or Consultant's notations marked on the returned submittal or letter of transmittal. Resubmittal is not required.
   3. Revised and Resubmit: Signifies item represented in the submittal appears to conform with the design concept and comply with the intent of the Contract Documents, but information is either insufficient or contains discrepancies which prevent the Architect and/or his Consultant from completing his review. Contractor is to resubmit revised information. Fabrication or procurement of the item and related work is not to proceed until the submittal is acceptable.
   4. Not Accepted: Signifies item represented in the submittal does not conform with the design concept or comply with the intent of the Contract Documents and is not recommended for incorporation into the Work. Contractor shall submit items responsive to the Contract Documents.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 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. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. 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.
   1. 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).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of seven 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.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. 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. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

C. 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.

D. Schedule of Tests and Inspections: Prepare 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. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified 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 may also serve as Project superintendent.

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.

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.

1.6 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 reinspecting.

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.

1.7 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.
   1. Refer to individual Sections for additional requirements.

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. 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.

H. 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.

I. 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 five days for initial review and each re-review of each mockup.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed unless otherwise indicated.

J. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings, unless specified otherwise on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

K. 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.

1.8 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. Payment for these services will be made by Owner.
   3. Costs for retesting and reinspecting 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 Responsibilities: Tests and inspections not explicitly assigned to Owner 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 at least 48 hours in advance of time when Work that requires testing or inspecting will 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 Section 013300 "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 preinstallation 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/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect, Owner, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect 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. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   6. 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, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency and/or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, 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 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 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 reinspecting 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 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. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should 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, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800

AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ACI	American Concrete Institute (Formerly: ACI International) www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AGA	American Gas Association www.aga.org	(202) 824-7000
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The) www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)	
ARI	American Refrigeration Institute (See AHRI)	
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers) www.asme.org	(800) 843-2763 (973) 882-1170
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636

AWMAC	Architectural Woodwork Manufacturers Association of Canada www.awmac.com	(403) 453-7387
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.gobrick.com	(703) 620-0010
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)	
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CFSEI	Cold-Formed Steel Engineers Institute www.cfsei.org	(866) 465-4732 (202) 263-4488
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(404) 622-0073
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.org	(706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(800) 328-6306 (847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CWC	Composite Wood Council (See CPA)	

DASMA	Door and Access Systems Manufacturers Association www.dasma.com	(216) 241-7333
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electronic Components Association www.ec-central.org	(703) 907-8024
ECAMA	Electronic Components Assemblies & Materials Association (See ECA)	
EIA	Electronic Industries Alliance (See TIA)	
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (703) 538-1616
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI)	
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (202) 370-1800
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369

ICPA	International Cast Polymer Alliance www.icpa-hq.org	(703) 525-0511
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America) www.ies.org	(212) 248-5000
IESNA	Illuminating Engineering Society of North America (See IES)	
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 981-0100
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ISAS	Instrumentation, Systems, and Automation Society (The) (See ISA)	
ISFA	International Surface Fabricators Association (Formerly: International Solid Surface Fabricators Association) www.isfanow.org	(877) 464-7732 (801) 341-7360
ISO	International Organization for Standardization www.iso.org	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association (See ISFA)	
LMA	Laminating Materials Association (See CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900

NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFPA	NFPA International (See NFPA)	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NHLA	National Hardwood Lumber Association www.nhla.com	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSPE	National Society of Professional Engineers www.nspe.org	(703) 684-2800
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(706) 882-3833
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 293-1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154

SPIB	Southern Pine Inspection Bureau www.spib.org	(850) 434-2611
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
UBC	Uniform Building Code (See ICC)	
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301 (312) 321-6802
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, LLC www.icc-es.org	(800) 423-6587 (562) 699-0543

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FG	Federal Government Publications www.gpo.gov	(202) 512-1800

GSA	General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742
USDA	Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory www.ars.usda.gov	(202) 720-3656

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CFR	Code of Federal Regulations Available from Government Printing Office www.gpo.gov/fdsys	(866) 512-1800 (202) 512-1800
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
	Available from National Institute of Building Sciences/Whole Building Design Guide www.wbdg.org/ccb	(202) 289-7800
USAB	United States Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)	

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014529 – TESTING AND INSPECTION

PART 1 - GENERAL

1.1 GENERAL

A. The preceding "General Conditions" are a part of these specifications and the Contractor shall consult them in detail in connection with this part of the work.

1.2 SCOPE OF WORK

A. Employment of a testing and inspection firm approved and paid for by the Owner. Approximate scope of testing and inspection shall be as indicated on the drawings and herein specified in the sections of the specifications.

1.3 TESTING AND INSPECTION CHARGES

A. For the following conditions, costs of testing and inspection services shall be paid for by the Contractor, apart from the Testing and Inspection.
   1. Costs arising from errors or omissions by the Contractor.
   2. Costs of concrete cores, of re-testing materials that fail, and of required identification of materials (mill tests, manufacturers certifications, etc.).
   3. Costs of test and inspections required to expedite the Contractors operations.

1.4 EARTHWORK

A. The Soils Engineer shall be notified for inspection by the Contractor and shall work in cooperation with the Architect. This inspection shall be made before any excavation is attempted on the site. If any undesirable conditions are encountered during Construction, the Soils Engineer shall be notified so that supplemental recommendations can be made. Tests shall be made to define maximum densities of all compaction work. All densities shall be expressed as a relative compaction, in terms of the maximum dry density obtained in the laboratory. The Soils Engineer shall supervise all engineered fill, and make field tests to insure compliance with the required placement of footings; methods of placing and compacting fills; filter and/or rock fill materials.

1.5 CONCRETE WORK

A. Reinforcement shall be positively identified by heat numbers and mill analysis. Otherwise, Contractor shall provide test by qualified laboratory, one test for each 5 tons or fraction thereof, each size and type of reinforcing steel. Cement shall be from tested bins and properly identified at the mixing plant. Contractor shall provide to the testing laboratory, aggregate samples for approval. Testing laboratory shall prepare 3 concrete cylinders for each 25 cubic yards, or fraction thereof placed – 2 cylinders to be tested at 7 days, and 1 cylinder at 28 days. Follow ASTM standards throughout.

1.6 GENERAL TESTS AND INSPECTIONS

A. Observe all building code test and inspection requirements. Notify proper State, County and City authorities, for their required inspections.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

END OF SECTION 014529

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:
   1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, 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.
   1. Water service is available at each facility.
   2. No “bulk” water will be provided. Contractor shall provide and pay for his/her own bulk water.

C. Electric Power Service from Existing System: Electric power from Owner's existing system at each facility is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
   1. Contractor shall make his/her own provisions for and pay for power used for on-site welding.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

C. 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.

D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste handling procedures.
   5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

D. 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.

2.2 FIELD OFFICE AND TEMPORARY STORAGE

A. Temporary offices: A temporary office is not required. However, the Contractor shall maintain and have available at all times, copies of the plans, specifications, shop drawings, samples, and other data pertinent to the Work for reference.

B. Provide suitable storage facilities for materials delivered to the site to protect materials from weather and damage.

C. Temporary structures of combustible materials shall be located at least 30'-0" away from permanent structures.

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: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures].

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. 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.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

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.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
   1. Provide electric distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   2. Connect temporary service to Owner's existing power source, as directed by Owner.

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.
   2. Install lighting for Project identification sign.

I. Telephone Service: Superintendent shall be available via cellular telephone from the hours of 7:00 a.m. to 5:00 p.m.
   1. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary parking areas for construction personnel.

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 or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
a. 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. Comply with progress cleaning requirements in Section 017300 "Execution."

G. Lifts and Hoists: Provide facilities 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.

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 on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 011000 "Summary."

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

D. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

G. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
   2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
   3. Insulate partitions to control noise transmission to occupied areas.
   4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   5. Protect air-handling equipment.
   6. Provide walk-off mats at each entrance through temporary partition.

H. 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; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding and torching 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 needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and 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.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:
   1. Section 012500 "Substitution Procedures" for requests for substitutions.
   2. Section 014200 "References" for applicable industry standards for products specified.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 012500 "Substitution Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

B. Product Selection Procedures:
   1. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered prior to bidding only.
      b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   2. Manufacturers:
      a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered prior to bidding only.
      b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
   3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Correction of the Work.

B. Related Requirements:
   1. Section 011000 "Summary" for limits on use of Project site.
   2. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by Contractor certifying that location and elevation of improvements comply with requirements.

B. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Dates: Indicate when cutting and patching will be performed.
   4. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. 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. Operational elements include the following:
      a. Primary operational systems and equipment.

b. Mechanical systems piping and ducts.
c. Control systems.
d. Communication and CCTV systems.
e. Fire-detection and -alarm systems.
f. Electrical wiring systems.
g. Operating systems of special construction.

2. Other Construction Elements: Do not cut and patch other construction elements or 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. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Equipment supports.
   d. Piping, ductwork, vessels, and equipment.
   e. Noise- and vibration-control elements and systems.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction 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.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems**,** 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; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. 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 local utility 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "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: Contractor shall Engage a professional engineer 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 limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. 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 rim 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. Identification: Owner's project Civil Engineer will establish property corners, benchmarks and two control points to set lines and levels at the site before work commences.

B. 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.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Contractor, as he deems necessary, shall establish and maintain additional 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.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

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 96 inches in occupied spaces and 90 inches in unoccupied spaces.

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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. 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.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
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.

I. 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.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. 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** or **prevent** interruption to occupied areas.

G. 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 neatly to minimum 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 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.

H. 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 practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical 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 minimize evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
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.

   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. 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 waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.
4. Contractor will coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. 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.

C. 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.

D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

F. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

G. 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.

H. 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.

I. 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.

3.8 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.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Section 017300 "Execution" for progress cleaning of Project site.
   2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
2. Complete startup and testing of systems and equipment.
3. Perform preventive maintenance on equipment used prior to Substantial Completion.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit outline of instructional program for demonstration and training specified in Section 017900 "Demonstration and Training."
5. Advise Owner of changeover in heat and other utilities.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
a. Project name.
b. Date.
c. Name of Architect.

d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:
   a. PDF electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep concrete floors broom clean in unoccupied spaces.

i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 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.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final PDF form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. 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, subsystem, and piece of equipment with 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 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, 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: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and 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 comprehensive table of contents for all volumes in each volume of the set.

D. 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 PDF file.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

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. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner'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, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system 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. Use designations for products indicated on Contract Documents.
   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 Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

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 and drawing or schedule designation or identifier where applicable.

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 MANUALS

A. Content: For each system, subsystem, 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, subsystem, and piece of equipment 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 and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard 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.

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 video recording, 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. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, 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 Owner's operating personnel.

D. 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.

E. 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 Section 017839 "Project Record Documents."

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Product Data.
   3. Miscellaneous record submittals.

B. Related Requirements:
   1. Section 017700 "Closeout Procedures" for general closeout procedures.
   2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints.
         2) General scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit one paper-copy set of marked-up record prints in addition to a PDF electronic files of scanned record prints.
         2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

D. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Owner. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Requirements:
   1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including learning objective and outline for each training module.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructor(s), including providing notification of dates, times, length of instruction time, and course content.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project record documents.
      e. Identification systems.

f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Demolition and removal of selected portions of building or structure as indicated, and as required to accommodate new construction.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:
1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.
1. Owner will retain “first right of refusal” for all demolished items.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.
1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Coordination of Owner's continuing occupancy of portions of existing building to ensure uninterrupted progress of Owner's on-site operations and of Owner's partial occupancy of completed Work.
   6. Coordination of concurrent work by Owner under separate contracts as indicated below:
      a. Roofing Work
      b. HVAC Work

C. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

B. Storage or sale of removed items or materials on-site is not permitted.

C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
   1. Existing Roof on existing building is currently under warranty and shall be protected during construction as required by Owner's warranty conditions.
   2. Existing HVAC Systems on existing building is currently under warranty and shall be protected during construction as required by Owner's warranty conditions.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
   1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
   1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary"

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Arrange to shut off utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   4. Disconnect, demolish, and remove fire-suppression systems, plumbing, equipment, and components indicated on Drawings to be removed. Coordinate demolition of this work with work of HVAC Package under separate contract by Owner.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.

5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.
   3. Coordinate this work with roof work under separate contract by Owner.

F. Wood Trim and Plaster: Carefully remove wood trim adjacent to interior plaster work to minimize damage to plaster work to remain. Remove loose plaster back to solid/sound plaster.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete (033000.A01), including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings and grade beams.
   2. Foundation walls and stem walls.
   3. Slabs-on-grade.

B. This Section also includes the following:
   1. Cast-in-place architectural concrete (033000.A30).
   2. Providing the granular drainage fill course beneath building floor slabs on grade.
   3. Providing foundation insulation.
   4. Providing foam void fill (geofoam) blocks to form and support existing pool void.

C. Related Requirements:
   1. Section 012200 “Unit Prices” for unit prices relating to work of this Section
   2. Section 099123 “Interior Painting” for colored (painted) concrete finish.
   3. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

C. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
      e. Flatwork technicians.
      f. Special concrete finish subcontractor.
      g. Manufacturer’s representative for waterproofing admixture.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, foam void fill (geofoam) installation, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, perimeter insulation installation, concrete repair procedures, and concrete protection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Foam Void Fill (Geofoam) Formwork Shop Drawings: Prepared geofoam manufacturer/installer showing dimensioned floor plans, elevations and sections for geofoam layout of each pool infill. Indicate location, size, and thickness of riser and step forms. Provide cross section of each form area indicating height and depth of each tier and thickness of each Geofoam layer. Provide plan view of each layer of Geofoam with each part identified and dimensioned.

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. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

F. Samples: For each of the following materials:
1. Form-facing panels.
2. Form ties.
3. Chamfers and rustications.
4. Vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Foam Void Fill (Geofoam)

C. Material Test Reports: For the following, from a qualified testing agency indicating compliance with requirements:
1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

E. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

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.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

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.
1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
   1. Waterproofing (capillary break) admixture manufacturer will test new concrete slabs for permeability.

1.7 PRECONSTRUCTION TESTING

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

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

C. Protect foam plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

A. 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 use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301.
   2. ACI 303.1.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   2. Metal, or other approved panel materials

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

D. Foam Void Fill (Geofoam) (033000.A04): Refer to Article later in this Section.

E. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch, minimum; nonstaining; in longest practicable lengths.

F. Rustication Strips (033000.A05): Metal, dressed wood, or rigid plastic, or with sides beveled and back kerfed; nonstaining; in longest practicable lengths.

G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars (033000.A06): ASTM A 615/A 615M, Grade 60, deformed.

B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

C. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

D. Plain-Steel Welded-Wire Reinforcement (033000.A09): ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. 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. Slab –on-grade supports: Provide supports specifically designed for bearing on soil.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray.
   2. Fly Ash: ASTM C 618, Class C.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size:
      a. 1-inch nominal for slabs on grade.
      b. ¾-inch nominal for all other locations.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
   1. Provide at concrete used for exterior stoop slabs.

G. Water: ASTM C 94/C 94M and potable.

H. Waterproofing (Capillary Break) Admixture: Admixture shall be formulated to react with water and alkali in the concrete to fill the capillaries within the concrete with calcium silicate hydrate. Admixture shall also have plasticizing properties. Admixture shall be used in lieu of a portion of the mix water, not in addition to the mix water.
   1. Manufacturer's Warranty: Submit manufacturer's standard warranty executed by an authorized company official. Manufacturer's warranty is in addition to, and not a limitation of other rights Owner may have under provisions of the Contract Documents.
      a. Warranty Period: Ten (10) years commencing on the date of acceptance of the Project by Owner or date of Substantial Completion, whichever is earliest.
      b. Warranty Terms: Terms to include moisture related failures, including all finish floor materials and labor.
   2. Basis-of-Design Products:
      a. Admixture: Provide "Concure Systems Admixture" as manufactured by Concure Systems, or comparable product submitted to and accepted by Architect prior to bidding.
      b. Accessories materials:
         1) Concure Systems topical vapor sealer as necessary when results from moisture testing by Concure indicate moisture vapor emission and/or relative humidity with slab exceeding acceptable levels.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops (033000.A13): Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/8 by 3/4 inch.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Greenstreak; Swellstop II, or comparable product from one of the following:
      a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP
      b. CETCO; Volclay Waterstop-RX
      c. Concrete Sealants Inc.; Conseal CS-231
      d. Henry Company, Sealants Division; Hydro-Flex.

B. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat dumbbell with center bulb.
   2. Dimensions: -6 inches by 3/8 inch thick; nontapered.

2.7 VAPOR RETARDERS (033000.A14)

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum perm rating of 0.036 US perms, a minimum puncture resistance of 2300 grams and a minimum tensile strength of 50 lbf/in. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Inteplast Group; Barrier-Bac VB-250, 11 mil.
      b. Meadows, W. R., Inc.; Perminator 10 mil.
      c. Raven Industries Inc.; Vapor Block 10.
      d. Stego Industries, LLC; Stego Wrap 10 mil Class A.

2.8 GRANULAR DRAINAGE/ CAPILLARY BREAK MATERIAL

A. Granular Drainage Fill (033000.A15): Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 4 sieve.

2.9 PERIMETER INSULATION

A. Foam-Plastic Board Insulation (072100.A01): Provide extruded-polystyrene board insulation complying with ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Type IV, 25 psi.

2.10 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment (033000.A21): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces, while improving slip resistance.
   1. Basis-of-Design Products: Subject to compliance with requirements, provide Curecrete Distribution Inc.; "Ashford Formula" or comparable product meeting specified performance requirements, submitted to and accepted by Architect prior to bidding.
   2. Performance Criteria:
      a. Abrasion Resistance: Improves abrasion resistance by not less than 30 percent over untreated concrete when tested in accordance with ASTM C 779.
      b. Coefficient of Friction: ASTM C 1028, on steel-troweled concrete samples versus tile, reduces slippage as follows:
         1) Dry: 0.71 untreated and with treatment not less than 0.86.
         2) Wet: 0.47 untreated and with treatment not less than 0.69.
      c. Hardening: Improves hardness by not less than 35 percent over untreated concrete when tested in accordance with ASTM C 39 after 28 days.
      d. Impact Resistance: Improves impact resistance by not less than 13 percent over untreated concrete when tested in accordance with ASTM C 805, rebound number.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   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. BASF Construction Chemicals - Building Systems; Confilm.
      b. Conspec by Dayton Superior; Aquafilm.
      c. Dayton Superior Corporation; Sure Film (J-74).
      d. Euclid Chemical Company (The), an RPM company; Eucobar.
      e. L&M Construction Chemicals, Inc.; E-CON.
      f. Meadows, W. R., Inc.; EVAPRE.
      g. SpecChem, LLC; Spec Film
      h. Unitex; PRO-FILM.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   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. BASF Construction Chemicals - Building Systems; Kure 200.
      b. Conspec by Dayton Superior; W.B. Resin Cure.
      c. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      d. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      e. L&M Construction Chemicals, Inc.; L&M Cure R.
      f. Meadows, W. R., Inc.; 1100-CLEAR.
      g. SpecChem, LLC; Spec Rez Clear.

2.12 FOAM VOID FILL (GEOFOAM)

A. General: Provide Geofoam blocks that have been factory fabricated to fit project dimensions; eliminating field cutting and site generated waste.

B. Rigid Cellular Polystyrene Geofoam Blocks (033000.A04): Molded blocks of cellular polystyrene comply with manufacturer's requirements, ASTM D6817 for Type EPS22, and the following:
   1. Minimum density: 1.35 pounds per cubic foot
   2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
   3. Compressive Resistance: at 1percent deformation shall be 8.8 psi.
   4. Water Absorption: Not greater than 4 percent.
   5. Blocks shall contain no CFC's, HCFC's, HFC's, or formaldehyde.

C. Geofoam Accessories:
   1. Gripper Plates: Manufacturer's standard galvanized barbed plates for installation between Geofoam layers.

2.13 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips (033000.A22):
   1. For expansion joints provide, ASTM D 1751, asphalt-saturated cellulosic fiber or W. R. Meadows; "Deck-O-Foam".
   2. For isolation joint filler strips, provide 30# asphalt saturated felt.

B. Semi-rigid Joint Filler (033000.A23): Two-component, semi-rigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: 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. Types I and II, nonload bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.14 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150/C 150M, 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: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150/C 150M, 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.

2.15 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. Cementitious Materials:

1. Use fly ash as needed to reduce the total amount of portland cement, which would otherwise be used, by not more than 15 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use waterproofing (capillary break) admixture in concrete mixtures for slabs on grade and trenching repair for existing slabs on grade.
2. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
3. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
4. 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 w/c ratio below 0.50.
5. Use corrosion-inhibiting admixture in concrete mixtures for exterior stoop slabs, stairs and ramps.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Grade Beams: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.51.
3. Slump Limit: 4, plus or minus 1 inch.
4. Air Content: Non-air-entrained for 3/4-inch–nominal maximum aggregate size.

B. Foundation Walls and Cast-in-Place Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.51.
3. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.42.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Slabs-on-Grade (Exterior stoop slabs and stairs): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

E. Elevated Slabs (Slabs-on-Deck): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 3 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.17 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.18 FABRICATING FOAM VOID FILL (GEOFOAM)

A. Fabricate Geofoam blocks, square, and true to dimension.

B. Factory cut individual blocks for delivery to site and installation without the need for subsequent field cutting.
   1. Collect cut-off waste at factory for recycling as post-industrial content. Do not require field fabrication and disposal of Geofoam in the field.

C. Marking and Identification: Individual Geofoam blocks shall be marked as follows:
   1. Room number identification.
   2. Layer I.D. letter and part number identification.

2.19 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
   2. Waterproofing (Capillary Break) Admixture shall be added at the jobsite before discharge in accordance with admixture manufacturer's written instructions. The admixture manufacturer's representative shall be present at time of dosing admixture and initial concrete placement. Use for all concrete slabs on grade and elevated slabs.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.
   4. Waterproofing (Capillary Break) Admixture shall be added at the jobsite before discharge in accordance with admixture manufacturer's written instructions. The admixture manufacturer's representative shall be present at time of dosing admixture and initial concrete placement. Use for all concrete slabs on grade and elevated slabs.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), 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 (ACI 117M).

C. Utilize sides of trenches for forms whenever possible. Where sides of trenches cannot be used; design, erect, support and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure.

D. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

E. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch.

F. Limit concrete surface irregularities, designated by ACI 347 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, not exposed to view in final position.

G. Construct 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. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.
   3. Where architectural concrete is indicated, seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
   4. Construct forms tight enough to prevent loss of concrete mortar.

H. 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.

I. 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.

J. Chamfer exterior corners and edges of permanently exposed concrete.

K. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
   1. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.

3.2 FOAM VOID FILL (GEOFOAM) INSTALLATION

A. Geofoam Installation: Install blocks in layers at locations indicated on shop drawings. Hold dimensions on shop drawings and Architect's plans. Blocks shall incorporate positive mechanical connection of foam block layers.
   1. Place gripper plates between each layer of Geofoam in quantities as noted on shop drawings.

3.3 EMBEDDED ITEM INSTALLATION

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 303.

3.4 PERIMETER INSULATION

A. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

B. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

3.5 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 (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   3. Do not cut or puncture vapor retarder.
   4. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not 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.

3.6 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Following leveling and tamping of granular drainage fill course for building slabs on grade, place vapor retarder sheet with longest dimension parallel with direction of pour. Place, protect, and repair sheet vapor retarder according to ASTM E 1643, manufacturer's written instructions and as follows:
   1. Lap joints 6 inches and seal with manufacturers' recommended tape.
   2. Seal pipe penetrations with pipe boot made from vapor retarder material, seal with pressure sensitive tape and vapor retarder manufacturer's recommended mastic.
   3. Repair punctures and tears with patches of vapor retarder material, lapping 6 inches on all sides and sealing with pressure sensitive tape.
   4. Provide 10 to 11 mil vapor retarder beneath slabs-on-grade.

B. At trenches through existing slabs on grade, place vapor retarder over granular drainage fill/capillary break material and bring up tight to sides of opening to receive concrete. Extend vapor retarder up sides 2 inches and seal with asphaltic mastic. Lap joints 6 inches and seal with vapor retarder manufacturer's recommended mastic or pressure sensitive tape. Repair tears and punctures with patches of vapor retarder material lapping 6 inches on all sides of puncture/tear and seal with mastic of pressure sensitive tape. Seal all penetrations.

3.7 GRANULAR DRAINAGE FILL

A. Granular Drainage/Capillary Break Fill Course: Cover vapor retarder with not less than 6 inches of granular drainage fill material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 1/2 inch.
   1. Compaction Requirements: Compact to within 95 percent maximum density in accordance with ASTM C 698, Standard Proctor compaction, at workable moisture content.
   2. At trenches through existing slabs on grade, provide at additional granular drainage fill/capillary break material to achieve a thickness of not less than 6 inches.

3.8 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 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/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.9 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install construction joints true to line, with faces perpendicular to surface plane of cast-in-place concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete. Align construction joint within rustications attached to form-facing material as occurs.
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 at 100 feet maximum. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. At Load Transfer Joints: Provide one of the following:
   a. 2 by 4 inch continuous keyway.
   b. One #4 by 12 inch long smooth dowel.
   c. Diamond dowel system.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
   a. Where joints are not specifically indicated, space joints at 15 feet on center (area not to exceed 225 sq ft.). Aspect ratio of joints not to exceed 1.5 to 1.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 WATERSTOP INSTALLATION

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.
1. Provide at elevator pits.

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.

3.11 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless water was withheld at batch plant, amount withheld was documented in writing and adding withheld water is acceptable by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
   1. 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 is 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 not to 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 (ACI 301M) and ACI 303.1 for architectural concrete.
   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. Do not permit vibrators to contact forms.

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. Concrete slab repairs at trenches shall be flush with adjacent concrete surface.
   6. 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 use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. 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.

3.12 FINISHING FORMED SURFACES

A. Rough-Formed Finish: 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 (033000.A16): 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. For architectural concrete exposed to view on the interior of the building, fins and other projections shall be removed flush with adjacent surface of concrete.
   2. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish (033000.A17): 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.
      a. Apply to concrete surfaces exposed to public view on vertical surfaces of sides of ramps, at sides of stairs, at lightpole bases and at architectural concrete.

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.

3.13 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. 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 to receive trowel finish.

C. 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 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. Do not burnish concrete.
   2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).
   3. Finish slab repairs at trenches to be flush with adjacent concrete surfaces.

D. Broom Finish (033000.A18): Apply a broom finish to traffic surfaces of exterior concrete platforms, steps, 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.

3.14 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.15 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 (ACI 301M) 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 (1 kg/sq. m 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 remainder of 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, as follows:
1. 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. Use moisture-retaining covers to cure concrete slab surfaces to receive all types of floor coverings.
    b. Use moisture-retaining covers to cure concrete slab surfaces to receive penetrating liquid floor treatments and sealed concrete floor treatments.
2. 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. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.16 LIQUID FLOOR TREATMENT APPLICATION

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.17 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least four month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
   1. Where control/contraction joints extend to the exterior of the building, beyond aluminum storefront, curtain wall and similar framing, completely fill joints with semi-rigid joint filler from exterior to inside face of framing. Exposed joint shall be completely filled and made water-tight.
   2. Where control/contraction joints occur in floors indicated to receive penetrating sealed concrete finish.

3.18 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 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) 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 (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). 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 matches 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 (0.25 mm) 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 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.
   4. 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 (6 mm) 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.
   5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) 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 (19-mm) 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.
   6. Repair random cracks and single holes 1 inch (25 mm) 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.

3.19 FIELD QUALITY CONTROL

A. Special Inspections and Testing: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:
   1. Steel reinforcement placement.
   2. Headed bolts and studs.
   3. Verification of use of required design mixture.
   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/C 172M 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. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
   2. Slump: ASTM C 143/C 143M; 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 C 231/C 231M, 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 (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. 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.
   7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   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 (3.4 MPa).
   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, 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 do not comply with the Contract Documents.

3.20 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:
1. Loose steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:
1. Section 012200 “Unit Prices” for unit prices relating to work of this Section
2. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
3. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
4. Section 055000 “Metal Fabrications” for furnishing steel lintels and shelf angles for unit masonry.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:
1. Special brick shapes.
2. Weep holes and cavity vents.
3. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For exposed brick, include test report for efflorescence according to ASTM C 67, including testing for Initial Rate of Absorption (IRA).
      c. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C 67 or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
      d. For concrete masonry units, include data and calculations establishing average net-area compressive strength of units.
   ~~2.~~ Integral water repellant used in CMUs.
   3. Cementitious materials. Include name of manufacturer, brand name, and type.
   4. Mortar admixtures.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Field Sample Panels: Build sample panels integral with wall construction to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution. Comply with requirements in Section 014000 "Quality Requirements" for field samples.
   1. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
   2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
   3. Include all masonry accessories, including but not limited to through wall flashing and cavity drainage materials.
   4. Protect approved sample panels from the elements with weather-resistant membrane.
   5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
      a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
   6. Subject to compliance with requirements, approved field sample(s) may become part of the completed Work.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Contractor to inspect existing wall for evidence of masonry cells filled with grout, vermiculite, or perlite and report findings to Architect. New construction shall contain filled cells to match existing

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. General: Contractor to inspect existing wall for evidence of masonry cells filled with grout, vermiculite, or perlite and report findings to Architect. New construction shall contain filled cells to match existing.

B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

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

E. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

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

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for outside corners unless otherwise indicated.
   3. Provide double bullnose units for tops of walls as indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) ACM Chemistries; RainBloc.
         2) BASF Aktiengesellschaft; Rheopel Plus.
         3) Grace Construction Products, W.R. Grace & Co. – Conn.; Dry Block.

C. CMUs (042000.A01): ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
   2. Density Classification: Lightweight.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
      a. Match sizes of existing CMU units as required for infill at existing walls and as indicated on drawings.

2.5 MASONRY LINTELS

A. Masonry Lintels (042000.A10): Prefabricated (site cast) or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
   1. Bond Beams are designated as (042000.A11)

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I ~~or II~~, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ACM Chemistries; RainBloc for Mortar
      b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
      c. Grace Construction Products, W. R. Grace & Co. – Conn; Dry-Block Mortar Admixture

H. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars (042000.A23): ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General (042000.A24): ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized carbon steel, Class B-2.
   2. Exterior Walls: Hot-dip galvanized carbon steel, Class B-2.
   3. Wire Size for Side Rods: 0.148-inch diameter.
   4. Wire Size for Cross Rods: 0.148-inch diameter.
   5. Wire Size for Veneer Ties: 0.148-inch diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Truss type with single pair of side rods.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
   3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.9 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: L-shaped steel bolts complying with ASTM A307, Grade A (ASTM 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and , where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

C. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 unless otherwise indicated.
   3. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F738M) and nuts, ASTM F594 (ASTM F836M).

D. Stainless Steel Dowels: ASTM A 276 or ASTM A666, Type 304, ½ inch diameter and not less than 5 inches long to provide at least 2 inch embedment in to adjoining units/substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler (042000.A35): Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.
   1. Basis of Design Product: W.R. Meadows; “Ceramar”.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

C. Isolation Strip Flashing (042000.A42): Provide self-adhering, polyethylene-sheet backed rubberized asphalt membrane, 40 mils thick.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work included, but are not limited to, the following:
      a. Air-Shield by W. R. Meadows, Inc.
      b. Blueskin by Henry Corp.
      c. CCW 705 by Carlisle Coatings & Waterproofing.
      d. Hyload S/A Through Wall Flashing by Hyload, Inc.

2.11 MASONRY-CELL FILL

A. Loose-Fill Insulation (042000.A44): Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
   1. Verify and match existing conditions prior to installation

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Do not use acidic cleaners on manufactured stone masonry.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type N.
   3. For mortar parge coats, use Type S or Type N.
   4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   5. For interior nonload-bearing partitions, Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
   3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

H. Coordination with Spray-Applied Membrane Air Barrier Coating: Adjustable veneer anchors shall be installed after to application of air barrier.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond pattern or to match adjacent conditions where existing conditions will not permit running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
   1. Fill cores in brick and hollow CMUs with grout or mortar under through-wall flashing.
   2. Fill base of wall between brick and CMUs (collar joint) with grout as indicated and apply mortar across top if insulation and grout to form a mortar wash directly beneath horizontal leg of through-wall flashing.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
   3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:
   1. Fully bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Fully bed webs in mortar in all courses of piers, columns, and pilasters.
   3. Fully bed webs in mortar in grouted masonry, including starting course on footings.
   4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
   5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Rake out mortar joints at pre-faced CMUs and glazed brick to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, and air barriers unless otherwise indicated.

G. Strike mortar joints flush in non-exposed locations and surfaces to receive a surface applied products and air barrier coatings. Striking shall be done in a careful manner so that mortar is not pulled from the edge of any masonry unit; joints to remain full or mortar with no gaps.
   1. Mortar joints and masonry shall be free of voids exceeding ¼ inch across. Mortar droppings shall be removed from brick ties and all other surfaces accepting air barrier.

3.6 MASONRY-CELL FILL

A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units or provide rigid anchors.

D. Provide continuity at corners by using prefabricated L-shaped units or provide rigid anchors.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. At 4-hour fire-rated walls, fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. At 2-hour fire-rated walls, install sash block on each side of joint, install preformed gasket, rake back mortar to allow for installation of backer rod and sealant, or install square-end block on each side of joint, fill head joint between block with ceramic fiber felt, rake back mortar to allow for installation of backer rod and sealant.
   3. At non-fire-rated walls, install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
   4. At locations in infill walls where existing joints should be continued through the wall.

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to TMS 402/ACI 530/ASCE 5 as follows:
1. Level “B” for all areas except High Wind Shelter areas.
2. Level “C” for High Wind Shelter areas.
3. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
4. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
5. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on field sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Initially, clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20. Where initial cleaning results are not satisfactory as judged by Architect from testing on mockup, proceed to cleaning with proprietary cleaners.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."
10. Clean manufactured stone masonry with according to manufacturer's written instructions.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

3.15 SURFACE PREPARATION

A. General: This project will have fluid-applied Air Barrier material applied to the cavity side of the CMU. Special attention and care must be taken to provide a smooth, filled surface to receive the membrane. The care is necessary to insure the design performance of the selected materials. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
   1. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane.
   2. CMU surfaces shall be free from projections.
   3. Strike all mortar joints flush to the face of the concrete block.
   4. Fill all voids and holes greater than ¼ inch across at any point with mortar, sealant or other approved fill material.
   5. Surface irregularities exceeding ¼ inch in height or sharp to touch shall be ground flush or made smooth.
   6. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
   7. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

END OF SECTION 042000

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof deck (053100.A01)

B. Related Requirements:
1. Section 012200 “Unit Prices” for unit prices relating to work of this Section
2. Section 012300 “Alternates” for alternates effecting work of this Section.
3. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
4. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
5. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
6. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
7. Section 099123 "Interior Painting" for finish painting of deck.

C. Products Furnished but not Installed Under this Section:
1. Mesh spacers and acoustical insulation strips for the acoustical deck shall be installed under work of Section 075216.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK (053100.A01)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Canam United States; Canam Group Inc.
   2. Consolidated Systems, Inc.; Metal Dek Group
   3. Epic Metals Corporation
   4. New Millennium Building Systems, LLC.
   5. Nucor Corp; Vulcraft Group
   6. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Galvanized and Shop-Primed Steel Sheet: Provide where specifically indicated. ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G90 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   3. Deck Profile: As indicated.
   4. Profile Depth: As indicated.
   5. Design Uncoated-Steel Thickness: As indicated.
   6. Span Condition: Triple span or more.
   7. Side Laps: Overlapped.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align pans of acoustical deck panels over full length of pan runs.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated, and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter.
   3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel framing and supports for overhead doors.
2. Miscellaneous Steel Framing and Supports for:
a. Storefront.
b. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Shelf angles (055000.A05)
8. Alternating tread device (055000.A08)
9. Metal bollards (055000.A14)
10. Metal downspout boots (055000.A16)
11. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:
1. Section 012100 “Allowances” for those allowances effecting work of this Section.
2. Section 012200 “Unit Prices” for those unit prices effecting work of this Section.
3. Section 012300 “Alternates” for those alternates effecting work of this Section.
4. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
5. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
6. Section 051200 "Structural Steel Framing."

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for overhead doors.
2. Steel framing and supports for countertops.

3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Shelf angles.
7. Metal ladders.
8. Metal bollards.
9. Metal downspout boots.
10. Loose steel lintels.
11. Miscellaneous steel framing and supports.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

B. Structural Performance of Ladders: Ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.

H. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

I. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.
   2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 (A1).
   1. Refer to Section 083329 for additional requirements regarding installation of side sliding grilles.

E. Anchor Bolts: ASTM F 1554, Grade 55, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. 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.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting," and Section 099600 "High-Performance Coatings."

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS (055000.A01)

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Furnish inserts for units installed after concrete is placed.
   2. Galvanize miscellaneous framing and supports for exterior application and where indicated for interior applications.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with [zinc-rich primer] [primer specified in Section 099600 "High-Performance Coatings"] where indicated.

2.7 SHELF ANGLES (055000.A05)

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
   1. Tread depth shall be not less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, tread width shall be not less than 7 inches (178 mm), and riser height shall be not more than 9-1/2 inches (241 mm).
   2. Tread depth shall be not less than 8-1/2 inches (216 mm)exclusive of nosing or less than 10-1/2 inches (267 mm) including the nosing, tread width shall be not less than 7 inches (178 mm), and riser height shall be not more than 8 inches (203 mm).
   3. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
   4. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."

B. Galvanize and prime steel alternating tread devices, including treads, railings, brackets, and fasteners.

C. Prime steel alternating tread devices, including treads, railings, brackets, and fasteners, with primer specified in Section 099600 "High-Performance Coatings."

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim. Prime interior miscellaneous steel trim.

2.10 METAL BOLLARDS (055000.A14)

A. Fabricate metal bollards from Schedule 40 steel pipe of diameter indicated, having a 1/4-inch wall-thickness, unless another wall thickness is indicated on the drawings.

B. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
   1. All bollards shall be filled with concrete.

C. Galvanize bollards. Prime bollards with primer specified in Section 099600 "High-Performance Coatings."

D. Pre-Manufactured Bollard Post Sleeves: Provide a pre-manufactured bollard post sleeve with integral domed cap. Bollard sleeve shall be manufactured from high density polyethylene (HDPE). Sleeve surface shall be smooth. Diameter of sleeve be slightly larger than outside diameter of bollard. Furnish with manufacturer's standard installation accessories. Color as selected by Architect from full range of manufacturer's standard colors.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide "HDPE Bollard Covers" as manufactured by Omega Industrial Products. Comparable products from other manufacturers will be considered that meet specified requirements, and which are submitted to and accepted by Architect prior to bidding.

2.11 METAL DOWNSPOUT BOOTS (055000.A16)

A. Provide downspout boots made from cast aluminum in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
   1. Outlet: Vertical, to discharge into pipe.

B. Prime boots with primer specified in Section 099600 "High-Performance Coatings."

2.12 LOOSE BEARING AND LEVELING PLATES (055000.A21)

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.13 LOOSE STEEL LINTELS (055000.A22)

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

2.14 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.15 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

C. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.

D. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

E. Install pre-manufactured bollard post sleeve at each bollard in accordance with sleeve manufacturer's written instructions. Seal bottom of sleeve to bollard post to inhibit removal.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Shop-fabricated steel railing system (055213.A01).
   2. Removable steel railing system (055213.A09).
   3. Handrails:
      a. Wall-mounted steel (055213.A01).

B. Related Requirements:
   1. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.
   2. Section 092116 "Non-Structural Metal Framing" for metal backing for anchoring railings.
   3. Section 096600 “High-Performance Coatings” for painting railings.

1.2 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 anchorages for railings. 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.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Railing brackets.
   3. Grout, anchoring cement, and paint products.

B. Shop Drawings: For each railing and handrail type, including plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters. Sample shall be of a fully-assembled unit not less than 2 feet in height and 2 feet in length.
   2. Fittings and brackets.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. Evaluation Reports: For post-installed anchors, from ICC-ES.

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."
   2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
   1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
      a. At enclosed egress stairs provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface

2.3 STEEL AND IRON

A. General: Provide tube or pipe as determined from fabricator's engineering design.

B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

A. General: Provide the following:
   1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
   2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
   2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
   1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with Section 09 96 00 "High-Performance Coatings."

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
   1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   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 flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours, color and finish of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form Changes in Direction as Follows:
   1. As detailed.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

Q. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
   1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
   2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
   3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
   4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with primers specified in Section 099600 "High-Performance Coatings."
2. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Where indicated, anchor posts to metal surfaces by welding to anchoring plate or welding to curb angle as indicated and with as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld plates to post and bolt plate to metal supporting surfaces.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. At exterior installations, leave anchorage joint exposed, recess anchoring material ½-inch to allow for sealant.

D. At interior installations, tool anchoring material flush with adjacent surface.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 3.0-mil dry film thickness.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking, cants, and nailers.
4. Wood furring.
5. Plywood blocking panels.
6. Plywood backing panels.
7. Repair of existing glulam structure.

B. Related Requirements:
1. Section 012300 “Alternates” for those alternates affecting work of this Section.
2. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Shop Drawings:
1. For glulam repair products designed to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

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 defines as to those performed for repair of existing glulam structure that is similar to that indicated for this project

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to inspect existing gluelam for defects and design glulam reinforcing and repair to comply with design loads.

B. Structural Performance: Provide glulam reinforcing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As required to support rooftop unit loads.
   2. Glulam reinforcing shall be provided to repair all glulam defects indicated on report of by a qualified professional engineer.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness.

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood sills, sleepers, blocking, farming and similar concealed members associated with refrigerator/freezer in contact with masonry or concrete.
   2. Wood floor plates that are installed over concrete slabs-on-grade.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
   1. Framing for raised platforms.
   2. Concealed blocking and furring.
   3. Plywood backing panels.

2.5 DIMENSION LUMBER FRAMING (061000.A01)

A. Framing (061000.A01): No. 2 grade.
   1. Species:
      a. Hem-fir (north); NLGA.
      b. Mixed southern pine; SPIB.
      c. Douglas fir-larch; WCLIB or WWPA.
      d. Redwood (provide at kitchen refrigerator/freezer) as indicated.

2.6 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking, grounds and nailers (061000.A13).
   2. Curbs and cants (061000.A14).
   3. Furring (061000.A15).
   4. Fire-retardant treated wood blocking and nailers (061000.A16).
   5. Fire-retardant treated wood furring: (061000.A18).

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
   1. Mixed southern pine; SPIB.
   2. Spruce-pine-fir; NLGA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine; No. 2 grade; SPIB.
   2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 MISCELLANEOUS PLYWOOD PANELS FOR BLOCKING

A. General: DOC PS 1, Exposure 1, CD, non-fire-retardant treated and fire-retardant treated as noted below, in thickness indicated or, if not indicated, not less than 5/8-inch nominal thickness.
   1. Plywood blocking and backing panels, non-fire-retardant treated (061000.A19).
   2. Fire-Retardant-Treated Plywood blocking and backing panels (061000.A20).
      a. Note that plywood equipment backing panels are specified in Article below.

2.8 PLYWOOD BACKING PANELS (061000.A20)

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.9 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 and ICC-ES AC193 as appropriate for the substrate.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.10 MISCELLANEOUS MATERIALS

A. Flexible Strip Flashing (061000.A12):
   1. Fire Propagation Characteristics: When flexible strip flashing is used in exterior walls, the flashing shall pass NFPA 285 testing as part of an approved assembly. Flashing shall be compatible with air barrier coating specified in Section 072729.
   2. Product Characteristics:
      a. Self-adhering, membrane, 40 mils thick.
      b. Flashing shall function as an air, vapor and water barrier.
   3. Basis-of-Design Product: Subject to compliance with requirements, provide Carlisle Coatings and Waterproofing; “Fire Resist 705FR-A.”
      a. Comparable products from the following, meeting specified requirements, will be considered when submitted to and accepted by Architect prior to bidding:
         1) Henry Corp.
         2) BASF.
         3) W. R. Grace.

B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
   3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
   2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring vertically at 24 inches o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
   1. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
   2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
   1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

3.5 FLOOR JOIST FRAMING INSTALLATION

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
   1. Where supported on wood members, by using metal framing anchors.
   2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

C. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

D. Provide solid blocking between joists under jamb studs for openings.

E. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
   1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

F. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
   1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal-size lumber, double-crossed and nailed at both ends to joists.
   2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior wood trim.
   2. Interior veneered plywood.

B. Related Sections include the following:
   1. Section 012300 “Alternates” for alternates effecting work of this Section.
   2. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
   3. Section 088000 "Glazing" for glass for display case doors and shelves.
   4. Section 123200 “Manufactured Wood Casework” for premanufactured casework.

C. Products Installed but not Furnished under this Section:
   1. Factory-primed flush wood doors.

1.2 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.

B. Balanced Construction: Where exposed face of a panel is surfaced with high pressure plastic laminate and the opposite (back) surface shall receive a cabinet liner or backer sheet when that surface is not exposed to view. All countertops shall have backer sheets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including hardware, accessories and solid-surfacing material.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
   4. Show dimensioned layouts, elevations, sections and connections for display case door and shelving systems.

C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

D. Samples for Verification:
   1. For each species and cut of lumber and wood trim with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 10 inch long for trim, including railing cap.
   2. Veneer-faced panel products with transparent finish, with 1/2 of exposed surface finished, 8 by 10 inches for each species and cut of veneered panel. Include at least one face-veneer seam and finish as specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product, signed by product manufacturer.

B. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. 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 of not less than seven years under the current company name.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and plastic laminate finishes.

D. 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.
1. Comply with “Custom” grading requirements, unless specifically specified otherwise.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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 "Project Conditions" Article.

B. Stack lumber, trim, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install interior architectural woodwork materials that are wet, moisture damaged, or mold damaged.
1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 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 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: White Maple, plain sliced/plain sawn or All-sapwood White Birch plain sliced/plain sawn.

C. Wood Products: Comply with the following:
1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.2 INTERIOR WOOD TRIM, MOLDINGS AND WALL CAP – TRANSPARENT (064023.A01)

A. Hardwood Lumber Trim for Transparent Finish: Comply with AWI, Section 300, Grade "Custom".
1. Species and Grade: Plain Sliced White Birch or White Maple – Stained to match existing or Architect Sample as indicated on Material Finish Legend.
2. Maximum Moisture Content: 13 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Use for lumber trim wider than 6 inches.
5. Veneered Material: Not allowed.
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.
8. Profiles: Refer to Drawings for configurations and profiles required.

2.3 INTERIOR VENEERED PLYWOOD (064023.A07)

A. Hardwood Veneer Plywood: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1, made without urea-formaldehyde adhesive.
1. AWI Grade: Premium.
2. Face Veneer Species and Cut:
a. Provide Plain-sliced White Birch or White Maple where indicated on Material Finish Legend to match existing wood.
3. Veneer Matching of Veneer Leaves: Bookmatch and end match.
4. Veneer Matching within Panel Face: Center-balance match.
5. Construction: Veneer core.
6. Thickness: 0.75 inch, unless otherwise indicated.
7. Panel Size: 48 by 96 inches or greater.
8. Glue Bond: Type II (interior).
9. Finish: Field finished by others.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
   2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication, including assembly 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. Notify 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. Shop-cut openings to maximum extent possible 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.
   1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all areas and conditions where solid surfacing fabrications will be installed. Notify Architect of any conditions that would adversely affect the installation. Do not proceed with installation until unsatisfactory conditions are corrected.
   1. Commencement of installation is construed as acceptance of the adjacent surfaces and conditions.

3.2 PREPARATION

A. Before installation, condition 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 backpriming.

3.3 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. 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.

F. Ornamental Woodwork: Install without distortion so units 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. Maintain veneer sequence matching of units with transparent finish.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Penetrations in fire-resistance-rated walls.

B. Related Sections:
1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:
1) UL in its "Fire Resistance Directory."

C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grace Construction Products.
2. Hilti, Inc.
3. Johns Manville.
4. Specified Technologies Inc.
5. 3M Fire Protection Products.
6. Tremco, Inc.; Tremco Fire Protection Systems Group.
7. USG Corporation.

2.2 PENETRATION FIRESTOPPING (078413.A01)

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls fire-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fillers for sealants.
2. Substrate primers.
3. Collars.

2.3 FILL MATERIALS

A. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

B. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

C. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

D. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

E. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

F. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inchesof firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Firestopping Manufacturer's representative shall perform and inspections of penetration firestopping. Contractor shall notify Architect and manufacturer's representative no later than seven days after penetration firestopping is complete to schedule inspection.
   1. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
   2. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Joints in or between fire-resistance-rated constructions. (078446.A01)

B. Related Sections:

1. Division 07 Section "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
a. Fire-resistive joint system products bear classification marking of qualified testing agency.
b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
1) UL in its "Fire Resistance Directory."

C. Pre-installation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS (078446.A01)

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Grace Construction Products.
      b. Hilti, Inc.
      c. Johns Manville.
      d. Specified Technologies Inc.
      e. 3M Fire Protection Products.
      f. Tremco, Inc.; Tremco Fire Protection Systems Group.
      g. USG Corporation.

C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inchesof joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Fire-Resistive Joint System manufacturer's representative will perform inspections of completed installation of work of this Section. Contractor shall notify Architect and manufacturer's representative not later than seven days after completion of fire-resistive joint system installation to schedule inspection.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

B. Wall-to-Wall, Fire-Resistive Joint Systems:
   1. UL-Classified Systems: WW-S-0000-0999.
   2. Assembly Rating: 2 hours.
   3. Nominal Joint Width: As indicated.

4. Movement Capabilities: Class II - 25 percent compression or extension.
5. L-Rating at Ambient: As selected by Contractor to suit project conditions.

C. Floor-to-Wall, Fire-Resistive Joint Systems:
1. UL-Classified Systems: FW-S-0000-0999.
1. Assembly Rating: 2 hours.
2. Nominal Joint Width: As indicated.
3. Movement Capabilities: Class II - 25 percent compression, extension, or horizontal shear.
4. L-Rating at Ambient: As selected by Contractor to suit project conditions.

D. Head-of-Wall, Fire-Resistive Joint Systems:
1. UL-Classified Systems: HW-S-0000-0999.
2. Assembly Rating: 2 hours.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II - 25 percent compression or extension.
5. L-Rating at Ambient: As selected by Contractor to suit project conditions.

E. Perimeter Fire-Resistive Joint Systems:
1. UL-Classified Perimeter Fire-Containment Systems: CW-S-0000-0999.
2. Integrity Rating: 2 hours.
3. Insulation Rating: 1 hour.
5. Linear Opening Width: As indicated.
4. Movement Capabilities: Class II - 25 percent compression or extension.
5. L-Rating at Ambient Temperature: As selected by Contractor to suit project conditions.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Urethane joint sealants.
3. Polyurea joint sealants.
4. Latex joint sealants.

B. Related Sections:
1. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
2. Section 088000 "Glazing" for glazing sealants.
3. Section 092900 "Gypsum Board" for acoustical sealant and sealing acoustical joints.
4. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
a. Each kind of sealant and joint substrate in exterior walls.
b. Sealant around perimeter of exterior windows/storefront.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

C. Field-Adhesion Test Reports: For each sealant application tested.

D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
1. Refer to Section 042000 “Unit Masonry” for sealant joint in masonry mockups.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. 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.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish 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: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
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 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

F. Keynote Designations: Refer to schedule at end of this Section for types and applicable substrates.
1. Sealant: (079200.A01).
2. Sealant with backer rod: (079200.A02).
3. Acoustical sealant: (079200.A04): Refer to Section 092900.
4. Tape Sealant (079200.A05).

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Non-Staining, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.

C. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.3 URETHANE JOINT SEALANTS

A. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.

B. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. May National Associates, Inc.; Bondaflex Sil-A 700.
c. Pecora Corporation; AC-20+.
d. Tremco Incorporated; Tremflex 834.

2.5 POLYUREA SEALANTS

A. Polyurea Sealant: Semi-rigid, self-leveling, 2-part type. Shore D hardness of 85 when tested in accordance with ASTM D 2240. Tensile strength of 1160 pounds per square inch when tested in accordance with ASTM D 412.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Curecrete Distribution Company, Inc.; Ashford Crete-Fill.
b. L&M Construction Chemicals, Inc.; Joint Tite 750.
c. Adhesives Technologies Corp.; Crackbond JF311.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings (079200.A04): ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape (079200.A05): Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. 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.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing 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:
      a. Concrete.
      b. Masonry.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer 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 OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind 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.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

3.4 CLEANING

A. 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 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 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Joints between different materials listed above.
   2. Urethane Joint Sealant: Multicomponent, pourable/nonsag, traffic grade, Class 25.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Joints within face brick and cast stone.
      c. Joints in formed metal wall panels.
      d. Joints within and at perimeter of storefront and curtain wall assemblies.
      e. Control and expansion joints.
      f. Joints between different materials listed above.
      g. Perimeter joints between materials listed above and frames of doors, windows and louvers.
      h. Control and expansion joints in ceilings and other overhead surfaces.
   2. Silicone Joint Sealant: Single component, non-staining, nonsag, neutral curing, Class 50.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Other joints as indicated, except for expansion and control joints.
   2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior control/contraction joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Control/contraction joints in concrete slabs indicated to receive sealed finish, and joints in slabs on grade extending to building exterior, seal watertight.
   2. Polyurea Joint Sealant: Polyurea, multi component, self-leveling, traffic grade.
   3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Vertical joints on exposed surfaces of interior unit masonry and concrete.
   2. Joint Sealant: Urethane, multicomponent, nonsag, Class 25.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint Sealant Application: Interior joints in vertical surfaces.
   1. Joint Locations:
      a. Vertical joints in exposed surfaces of gypsum drywall partitions.
      b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   2. Joint Sealant: Acrylic based, paintable.
   3. Joiont Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Sealant Location:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
   2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing, Silicone.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work.
   1. Interior hollow-metal doors (081113.A01).
   2. Interior hollow-metal frames (081113.A03).

B. Related Requirements:
   1. Section 012300 “Alternates” for alternates effecting work of this Section.
   2. Section 042000 “Unit Masonry” for embedding anchors for hollow-metal work into masonry.
   3. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
   4. Section 099113 “Exterior Painting” for field painting of hollow-metal work.
   5. Section 099123 “Interior Painting” for field painting of hollow-metal work.
   6. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Furnish a schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
   2. Elevations of each door type.
   3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   5. Locations of reinforcement and preparations for hardware.
   6. Details of each different wall opening condition.
   7. Details of anchorages, joints, field splices, and connections.
   8. Details of accessories.
   9. Details of moldings, removable stops, and glazing.
   10. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:
   1. For each type of exposed finish required, prepared on Samples of not less than 6 by 8 inches.
   2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
      a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.

b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

E. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Republic Doors and Frames.
4. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.

c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch (16 gauge).
d. Edge Construction: Model 1, Full Flush.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, or mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:
a. Materials: Uncoated, steel sheet, minimum thickness of 0.067 inch (14 gauge). Provide metallic-coated steel doors at restrooms janitor closets, and warehouse locations.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Face welded.

4. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Hollow-metal frames of uncoated steel sheet, minimum thickness of 0.053 inch (16 gauge).

B. Construction: Face welded.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 088000 "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
   3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
   4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
   5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
   6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      c. Compression Type: Not less than two anchors in each frame.
      d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
   6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
   7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

C. Provide high frequency hinge reinforcement on top hinge only (two additional 10 gauge reinforcements are welded at 3 places each) on all door frames.

D. Reinforce doors and frames to receive continuous hinges where scheduled.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
   6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
   8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Steel Doors:
      a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
      c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
      d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
   3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames for walls and ceilings (083113.A01).

B. Related Requirements:
   1. Section 042000 “Masonry” for coordinating doors and frames set in masonry.
   2. Section 077200 "Roof Accessories" for roof hatches.
   3. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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:
   1. Babcock-Davis.
   2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   3. Karp Associates, Inc.
   4. Larsen's Manufacturing Company.
   5. Milcor Inc.
   6. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges (083113.A01):
   1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   2. Locations: Wall and ceiling.
   3. Door Sizes:
      a. 24” x 24” unless otherwise specified.
      b. 12” x 12” where indicated for access to water shut-off valves.
   4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
      a. Finish: Factory prime.
   5. Metallic-Coated Steel Sheet for Door: Provide in restrooms and other wet areas. Nominal 0.064 inch, 16 gage.
      a. Finish: Factory prime.
   6. Frame Material: Same material, thickness, and finish as door.

7. Hinges: Manufacturer's standard.
8. Hardware: Provide hardware as follows:
    a. At non-public spaces provide latching hardware.
    b. At public spaces accessible to students, provide locking hardware.

D. Recessed Access Doors with Concealed Flanges:
1. Description: Door face recessed 1 inch for cementitious tile backer board and tile infill; with concealed flange to accommodate installation of adjacent construction and concealed hinge.
2. Locations: Walls indicated to receive tile.
3. Door Sizes:
    a. 24" x 24" unless otherwise specified.
    b. 12" x 12" where indicated for access to water shut-off valves.
4. Metallic-Coated Steel Sheet for Door: Provide in restrooms and other wet areas. Nominal 0.064 inch, 16 gage.
    a. Finish: Factory prime.
5. Hardware: Provide hardware as follows:
    a. At non-public spaces provide latching hardware.
    b. At public spaces accessible to students, provide locking hardware.

E. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Door Sizes:
    a. 24" x 24" unless otherwise specified.
    b. 12" x 12" where indicated for access to water shut-off valves.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
    a. Finish: Factory prime.
7. Metallic-Coated Steel Sheet for Door: Provide in restrooms and other wet areas. Nominal 0.040 inch, 20 gage.
    a. Finish: Factory prime.
8. Frame Material: Same material, thickness, and finish as door.
9. Hinges: Manufacturer's standard.
10. Hardware: Provide hardware as follows:
    a. At non-public spaces provide latching hardware.
    b. At public spaces accessible to students, provide locking hardware.

F. Fire-Rated, Recessed Access Doors with Concealed Flanges:
1. Description: Door face recessed 1 inch for cementitious tile backer board and tile infill and with with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange to accommodate installation of adjacent construction, self-closing door, and concealed hinge.
2. Locations: Fire-rated walls indicated to receive tile.
3. Door Sizes:
    a. 24" x 24" unless otherwise specified.
    b. 12" x 12" where indicated for access to water shut-off valves.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
6. Metallic-Coated Steel Sheet for Door: Provide in restrooms and other wet areas. Nominal 0.064 inch, 16 gage.
    a. Finish: Factory prime.
7. Hardware: Provide hardware as follows:
    a. At non-public spaces provide latching hardware.
    b. At public spaces accessible to students, provide locking hardware.

G. Hardware:
1. Latch: Cam latch operated by screwdriver.
2. Lock: Cylinder.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.5 FINISHES

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: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:
1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING

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 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Insulated service doors (083323.A02).

B. Related Requirements:
1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
1. Curtain slats.
2. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Manufacturers: Provide products meeting specified requirements from one of the following listed below. Refer to individual door types for "Basis-of-Design Products".
   1. Cookson Company.
   2. Cornell Ironworks, Inc.
   3. McKeon Rolling Steel Door Company, Inc.
   4. Overhead Door Corp.
   5. Raynor.
   6. Wayne-Dalton Corp.

B. Source Limitations: Obtain each type of overhead coiling doors and shutters from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: As indicated on Drawings, but not less than a uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
   2. Testing: According to ASTM E 330.
   3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

2.3 INSULATED SERVICE DOOR ASSEMBLY (083323.A02)

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Basis of Design Product: Subject to compliance with requirements, provide Overhead Door Stormtite #625 Series or comparable product meeting specified requirements, by one of the manufacturers listed in Article 2.1, submitted to and accepted by Architect prior to bidding.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.

D. Curtain R-Value: 7.0 deg F x h x sq. ft./Btu, minimum

E. Door Curtain Material: Galvanized steel, insulated.

F. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
   1. Basis-of-Design: Overhead Door Corporation; F265i Slat.
   2. Insulated-Slat Interior Facing: Metal.
   3. Insulation shall be foamed-in-place.
   4. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from aluminum extrusions and finished to match door.

H. Curtain Jamb Guides: Galvanized steel with painted exposed finish to match curtain slats to best extent possible.

I. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Face of wall.

J. Electric Door Operator:
   1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
   2. Operator Location: Top of hood.

3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Interior.
5. Emergency Manual Operation: Chain type.
6. Obstruction-Detection Device: Automatic photoelectric sensor and electric sensor edge on bottom bar.
   a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

K. Curtain Accessories: Equip door with weatherseals and astragal.

L. Door Finish:
1. Factory Primed and Powder-Coated Finish: Color as selected by Architect from manufacturer's full range of powder-coat finish colors.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

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.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, unless otherwise specified, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required. Door curtains greater than 18 feet wide shall be 22 gauge minimum as determined by door manufacturer.
2. Insulation: Fill slats for insulated doors with manufacturer's standard foamed-in-place thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch and minimum aluminum thickness of 0.032 inch.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
2. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
3. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.7 LOCKING DEVICES

A. Slide Bolt: For manually operated doors, fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: Cylinders standard with manufacturer and keyed to building keying system.
2. Keys: Three for each cylinder.

C. Chain Lock Keeper: Suitable for padlock.

D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
   1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
   2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene or nylon brushes.

C. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

D. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

E. Poll Hooks: Provide pole hooks and poles for doors more than 84 inches high.

2.9 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
   1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
   1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
   1. Electrical Characteristics:
      a. Phase: Single phase.
      b. Volts: 115 V.
      c. Hertz: 60.
   2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
   3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
   1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Key-operated “On/Off” switch with three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
   1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
   3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Intent: The intent of this Section is to provide finish hardware for the proper operation and control of all wood, hollow metal and aluminum doors in the Project. Prior to bidding, notify the Architect of any doors that do not have hardware meeting this intention.

B. This Section includes items known commercially as finish or door hardware that are required for swinging doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed. This Section includes, but is not necessarily limited to furnishing and installing complete, the following:
   1. Finish hardware for proper operation and control of all wood, aluminum and hollow metal doors, including hinges, locks and latch sets, closers, panic devices, auto-flushbolts, electric strikes, magnetic holders, removable mullions, cylinders, keys, miscellaneous stops, flat goods, weatherstripping and thresholds as required.
   2. Cylinder for access doors where specified.

C. Related work in other sections:
   1. Hollow metal doors, frames and silencers: Section 081113.
   2. Wood doors: Section 081416.
   3. Aluminum doors: Section 084113.

1.2 DEFINITIONS

A. "Finish Hardware" includes items known commercially as finish hardware which are required for swing, and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturers technical product data for each hardware item. Include information necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finishes.
   1. Manufacturer shall submit written certification confirming closers compliance with U.L. 10C.

B. Hardware Schedule: Submit a hardware schedule in a vertical format (horizontal format not acceptable), organized into sets, including the information below. Designations for door numbers and hardware sets in the schedule shall match those used in the Construction Documents for each opening.
   1. Hardware Schedule shall be coordinated with doors, frames, and related work to ensure proper size, thickness, hand function, and finish of door hardware.
   2. Catalog cuts of each type of exposed hardware unit, highlighted in color to indicate compliance with the Hardware Schedule.
   3. Type, style, function, size and finish of each hardware item.
   4. Name and manufacturer of each item.
   5. Fastenings and other pertinent information.
   6. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
   7. Mounting locations for hardware.
   8. Door and frame sizes and materials.
   9. Deviations from Specifications shall be noted in cover letter.

C. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.

D. Keying Schedule: Submit separate detailed schedule, at the same time as the Hardware Schedule, indicating keying for all locks and how Owner's instructions, on keying of locks has been fulfilled. Keying schedule must be approved before ordering any locks.

E. Pinning Transcript: Submit detailed schedule indicating each lock cylinder and core.

F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.4 QUALITY ASSURANCE

A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

B. Product/Material Qualifications: Manufacturer's product numbers are indicated for convenience in identifying finish hardware items. Unless otherwise indicated, manufacturer's description for indicated product number constitutes minimum standards of quality, design, function and performance required for each item to be incorporated into the Project.
1. It will be the responsibility of the Bidder to furnish with his Bid a list clarifying any deviations from these specifications written or implied, in order that a fair and proper evaluation be made. Those Bidders not submitting a list of deviations will be presumed to have Bid as specified.

C. Supplier Qualifications: A recognized Architectural Finish Hardware Supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years. Supplier shall be or employ an experienced Architectural Hardware Consultant (AHC) who is certified by and member of the Door and Hardware Institute. The Architectural Hardware Consultant shall be available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.
1. Supplier shall meet with the Owner to finalize keying requirements and obtain final instructions in writing.

D. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Pamphlets No. 80, No. 101 and of authorities having jurisdiction requirements. Provide only hardware which has been tested and listed by UL, FM or Warnock Hersey for types and sizes of doors required and complies with requirements of door and door frame labels.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

E. Standards: Comply with the requirements of the latest edition of the following standards, unless indicated otherwise:
1. American National Standards Institute (ANSI) Publications:
   a. A115 Series - Door and Frame Preparation.
   b. A156 Series - Hardware.
2. Builders Hardware Manufacturers Association (BHMA) Publications:
   a. 1201 - Auxiliary Hardware.
   b. 1301 - Materials and Finishes.
3. Door and Hardware Institute (DHI) Publications:
   a. Keying - Procedures, Systems, and Nomenclature.
   b. Abbreviations and Symbols.
   c. Hardware for Labeled Fire Doors.
   d. Recommended Locations for Builder's Hardware for Standard and Custom Steel Doors and Frames.
   e. Wood Door Standards W1, W2, WDHS-2, WDHS-3.
4. National Fire Protection Association (NFPA) Publications:
   a. NFPA Pamphlet No. 80 - Standards for Fire Doors and Windows.
5. International Building Code - current edition as adopted and amended by the authority having jurisdiction of the City of Duquesne, Missouri.
6. Americans with Disabilities Act (ADA).

F. Keying Conference: Conduct conference to coordinate the final installation of Owner provided permanent cores.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Section013100 as follows:
   1. Architectural Finish Hardware supplier (AFHS) shall conduct the preinstallation conference at the site. The AFHS shall instruct finish hardware installer on proper installation, adjustment and troubleshooting for each operable item of finish hardware specified. The AFHS shall observe the installation and adjustment of the first three locksets, closers and exit devices.

1.5 DELIVERY, STORAGE AND HANDLING

A. Package each hardware item in separate containers with all screws, wrenches, installation instructions and installation templates. Mark or tag each box with hardware heading and door number according to approved hardware schedule.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation. Provide a complete packing list showing items, door numbers and hardware headings with each shipment.

D. Store hardware in shipping cartons above ground and under cover to prevent damage.
   1. Provide secure lockup for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

E. Aluminum Door Hardware: If required by door manufacturer deliver hardware for aluminum doors as directed by the door supplier for factory installation.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.7 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 HARDWARE - GENERAL

A. Provide the materials or products indicated by trade names, manufacturer's name, or catalog number.

B. Provide manufacturer's standard products meeting the design intent of this Specification, free of imperfections affecting appearance or serviceability.

1. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
2. Provide hardware complete with all fasteners, anchors, instructions, layout templates, and any specialized tools as required for satisfactory installation and adjustment.
3. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
4. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated or approved. Finish screws exposed under any condition to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as
5. Finish all other hardware in accordance with the BHMA finish as follows, unless otherwise indicated in manufacturers screws to secure hardware.
6. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where indicated otherwise or where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex bolt fasteners.

C. Hardware is specified in the hardware schedule by set, type, and functions which have been selected as best meeting the application requirements. Acceptable products for each category are specified under PART 2 of this Specification.

2.2 SPECIAL REQUIREMENTS

A. Hinges:
1. Provide non-removable pins for all exterior doors and out-swinging corridor doors. Use nonrising pins for all other doors.
2. Pre-drill pilot holes for hinge fasteners at factory to suit hinge type.
3. Provide continuous hinges where specified.

B. Locksets:
1. All locksets shall meet or exceed ANSI A156.13-94, Grade 1 requirements.

C. Panic Devices:
1. All panic devices shall have touchbars made of stainless steel.
2. All latchbolts are to be deadlatching.

D. Closers:
1. Comply with manufacturer's recommendations for unit size based on door size, weather exposure and usage.
2. Provide parallel arms for all overhead closers, except as otherwise indicated.
3. All surface closers shall exceed ANSI A156.4 Grade 1 requirements in all aspects as called for below. All closers shall have certification by an independent testing laboratory of 10,000,000 cycles without failure. Provide special rust inhibitive primer (SRI) where specified.
4. Furnish all brackets, drop plates and any other necessary hardware required to insure proper installation.

2.3 KEYING

A. All permanent cores and keying to be by Stanley/Best Lock and furnished by Owner.
1. Hardware supplier shall be responsible for providing the correct type of cylinder for each hardware application, and supplying cylinder with correct tailpiece and/or cam.

2.4 HARDWARE FINISHES

A. Provide matching finishes for hardware units at each door to the greatest extent possible, unless otherwise indicated. In general, match items to the finish for the latch, lock or push-pull unit for color and texture.

B. Thresholds (087100.A01): Clear, anodized aluminum.
1. Handicap accessible threshold (087100, A02).
a. Product description or schedule:

1) 626 satin chrome-plated.
2) 630 satin stainless steel.

2.5 HARDWARE PRODUCTS

A. Hinges:
1. Specified manufacturer: IVES Hardware; an Allegion Company.
2. Acceptable substitutions:
a. Hager Companies.
b. McKinney Products Company; an ASSA ABLOY Group company.
c. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Continuous Gear-Type Hinges:
1. Specified manufacturer: IVES Hardware; an Allegion Company.
2. Acceptable substitutions:
a. Hager Companies.
b. McKinney Products Company; an ASSA ABLOY Group company.
c. Select Products Limited.

C. Locksets:
1. Specified manufacturer: Schlage Commercial Lock Division; an Allegion Company.
2. Substitutions: Not allowed. Products to match District standard.

D. Exit Devices:
1. Specified manufacturer: Von Duprin; an Allegion Company
2. Substitutions: Not allowed. Products to match District standard.

E. Closers:
1. Specified manufacturer: LCN Closers; an Allegion Company.
2. Substitutions: Not allowed. Products to match District standard.

F. Flatgoods:
1. Specified manufacturer: Ives Hardware; an Allegion Company.
2. Acceptable substitutions:
a. Burns.
b. Rockwood.

G. Stops:
1. Specified manufacturer: Ives Hardware; an Allegion Company.
2. Acceptable substitutions:
a. Burns Manufacturing Incorporated.
b. Hager Companies.
c. Rockwood Manufacturing Company.
d. Trimco

H. Overhead stops:
1. Specified manufacturer: Glynn-Johnson; an Allegion Company.
2. Acceptable substitutions:
a. Architectural Builders Hardware Mfg., Inc.
b. Ives Hardware; an Allegion Company.
c. Rixson Specialty Door Controls; an ASSA ABLOY Group.

I. Thresholds:
a. Specified manufacturer: Zero International.
2. Acceptable substitutions:
a. Hager Companies.
b. Pemko Manufacturing Co.
c. Reese Enterprises.
d. National Guard Products.

J. Door Gasketing:
a. Specified manufacturer: Zero International.
2. Acceptable substitutions:
a. Hager Companies.

b. Pemko Manufacturing Co.
c. Reese Enterprises.
d. National Guard Products.

K. Weatherstriping:
a. Specified manufacturer: Zero International.
2. Acceptable substitutions:
a. Hager Companies.
b. Pemko Manufacturing Co.
c. Reese Enterprises.
d. National Guard Products.

PART 3 - EXECUTION

3.1 PREPARATION

A. Carefully inspect doors, frames, and conditions under which hardware will be installed. Notify the Architect of any conditions that would adversely affect the installation or subsequent door operations. Do not proceed until unsatisfactory conditions are corrected.
1. Frames shall be verified, inspected, and confirmed by General Contractor as being plumb and true.

B. Refer to Sections 081113, 081416, and 084113 for additional installation requirements.

C. Prior to hardware installation, the Hardware Supplier shall meet with the Owner's Representative, Architect, and Hardware Installer to ensure the Installer has and understands the manufacturers' installation requirements for all hardware items.
1. The Supplier shall observe the installation of the first lockset, closer and panic device.

3.2 INSTALLATION

A. Mount Hardware units at heights indicated in respective DHI Standards, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

B. Install each hardware item in compliance with the manufacturer's instructions and written recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be field finished, coordinate removal, storage and reinstallation or application of surface protections with finishing work. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
1. Special care shall be taken to avoid damaging surrounding surfaces.

D. Provide fasteners and anchoring devices of suitable size, quantity, and type to secure hardware in proper position for heavy use and long life.
1. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Adjust door closers immediately upon installation. Adjust in exact conformance with manufacturer's printed instructions. Advance backcheck to eliminate shock at dead stop. Set latching speed to assure unassisted positive latching.
1. Degrees of swing of doors for self-limiting closers shall be maximum available.

F. Install each protection plate with a thinly-spread spot of mastic at its center to assure even contact before fastening with screws. Install all such plates on visual centers of closed doors. Set bottom edges of all such plates flush with door bottom.

G. Cut and fit thresholds to door frame profiles. Prepare thresholds for the attachment of strikes and clearance for spindles as required. Set thresholds in a continuously laid bed of polyisobutylene mastic sealant to completely fill voids and exclude moisture from every source.

H. Seal weather protection components attached to the exterior sides of doors and frames, such as drip caps and weatherstripping, in place with clear silicone caulk in such a manner as to ensure a continuously filled seam throughout the joinery.

I. Cut and fit weatherstripping accurately to provide the greatest possible continuity of the contact element. Adjust closer templating as required.

J. At exterior doors, obtain satisfactory operation of the installation, then apply a thin layer of clear silicone caulk under hinge leaves, and outside lock trim. Remove excess caulk after torqueing fasteners.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
   1. Clean adjacent surfaces soiled by hardware installation.

B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 INSTRUCTION AND INSPECTION

A. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

B. After hardware is installed and adjusted, the Supplier shall inspect the job with the Architect and the Contractor to determine if the hardware is functioning properly.
   1. Maintain the instruction sheets, layout templates, and any supplementary literature regarding hardware in a readable condition. Transmit all such items to the Owner's Representative, together with all spare parts, specialized tools, other accessories supplied with the hardware, and a copy of the approved hardware schedule at the time of instruction.

C. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units at no cost to the Owner. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

Door/Hardware Set Index	
Door #	**HWSet #**
A111	03
A113	01
A115	07
A117.1	06
A117.2	04
A117.3	05
A118	09
A119	09
A120	08
A120A	02
A124	05
A213	03
E103.2	11
E110	11
E158	11
E303	05

Door/Hardware Set Index	
Door #	HWSet #
S100	10
S101	10
S101.1	10
S102	10
S102.1	10
S103	10
S103.1	10
S104	03
S105	10
S106.1	10
S106.2	10
S106.3	06
S106.4	05
S106.5	05
S106.6	05
S206	12

HARDWARE SET 01

DOOR NUMBER:
A113

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 02

DOOR NUMBER:
A120A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 03

DOOR NUMBER:
A111 A213 S104

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQ'D	626	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4111 DEL SCUSH	689	LCN
2	EA	ARMOR PLATE	8402 34" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	ASTRAGAL	328AA	AA	ZER

HARDWARE SET 04

DOOR NUMBER:
A117.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4111 HEDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER

HARDWARE SET 05

DOOR NUMBER:
A117.3 A124 E303 S106.4 S106.5 S106.6

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER

HARDWARE SET 06

DOOR NUMBER:
A117.1 S106.3

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4011 H	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER

HARDWARE SET 07

DOOR NUMBER:
A115

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 08

DOOR NUMBER:
A120

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 09

DOOR NUMBER:

A118 A119

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8305 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET 10

DOOR NUMBER:

S100 S101 S101.1 S102 S102.1 S103
S103.1 S105 S106.1 S106.2

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
		HARDWARE BY DOOR / FRAME MANUFACTURER		

HARDWARE SET 11

DOOR NUMBER:

E103.2 E110 E158

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SFIC MORT CYLINDER	80-103 (VERIFY TYPE AND QUANTITY REQUIRED)	626	SCH

NOTE: PROVIDE NEW CYLINDER KEYED TO OWNERS MASTERKEY SYSTEM. VERIFY EXISTING CONDITIONS AND PROVIDE APPROPRIATE CYLINDER.

HARDWARE SET 12

DOOR NUMBER:
S206

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQ'D	626	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA	626	SCH
1	EA	SFIC COMBINATED CORE	BY OWNER	626	BES
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	ARMOR PLATE	8402 34" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP/HOLDER	FS495	626	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER
1	EA	ASTRAGAL	328AA	AA	ZER

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.
   3. Interior borrowed lites.

B. Related Sections:
   1. Section 012300 “Alternates” for those alternates effecting work of this Section.
   2. Section 102800 “Toilet, Bath and Laundry Accessories” for metal-framed mirrors.

1.2 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. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E 119: Fire Tests of Building Construction and Materials.

B. American National Standards Institute (ANSI):
   1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings.

C. Consumer Product Safety Commission (CPSC):
   1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials, Category II.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square. Submit the samples listing glass type corresponding to Glass Legend indicated on Drawings.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

B. Qualification Data: For Installers.

1.8 CLOSEOUT SUBMITTALS

A. Warranties: Sample of special warranties.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

F. 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's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

H. Pre-installation Conference: Conduct conference at Project site.
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.

1.10 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

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.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
   1. Design Wind Pressures: As indicated on Drawings.
   2. Design Snow Loads: As indicated on Drawings.
   3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
   4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
   5. 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, whichever is less.
   6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

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, ambient; 180 deg F, material surfaces.

2.2 GLASS PRODUCTS, GENERAL

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
   1. Obtain tinted glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

C. 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: 6.0 mm, except where specifically indicated otherwise.

D. 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.

E. 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. 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.
   3. 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.
   4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS

A. Heat-Treated Float Glass (088000.A02): ASTM C 1048; Type I; Quality-Q3; Class I (clear); fully tempered float glass.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other coated glass).
   4. Thicknesses: 1//4 inch (6.0 mm).
   5. Provide safety glazing labeling.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. EPDM complying with ASTM C 864.
   2. Silicone complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM or silicone gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.7 DECORATIVE GLASS FILM

A. Decorative Glass Film Overlay: Glass with decorative adhesive-backed colored film overlay. Use dimensionally stable, optically clear polyester film, 5mil minimum thickness, with UV stable, pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Basis-of-Design Products: Subject to compliance with requirements, provide LLumar.; "Frost Series – Glacier – No. NRM55-PS4"; or a comparable substitute product submitted to and accepted by Architect prior to bidding.
    a. Substitutions for convenience will not be considered after bidding.
2. Product Description: Single or multi-layered decorative film products, applied to interior glass surfaces, consisting of (from outboard surface to inboard surface):
    a. Removable release liner.
    b. Pressure sensitive adhesive with integral ultraviolet absorbers.
    c. Dyed or printed pattern layer of polyester film
3. Use: Suitable for interior applications.
4. Colors: As selected by Architect from manufacturer's standard range of available options.
5. Accessories: Provide accessories complying with glazing film manufacturer's requirements for application indicated, with proven record of compatibility with surfaces contacted.
    a. Adhesives: Pressure sensitive acrylic adhesive system.
    b. Cleaners, Primers and Sealers: Types recommended by glazing film manufacturer.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
    1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.
    1. Provide ground and polished edges for glass doors and shelving at display cases.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
    1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
    2. Presence and functioning of weep systems.
    3. Minimum required face and edge clearances.
    4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

F. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 GLAZING FILM INSTALLATION

A. General: Comply with glazing film manufacturer's written instructions for preparation and installation.
   1. Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges completely overlaying the back face of clean glass.
   2. Install film continuously in longest practicable lengths. Install with no gaps and no overlaps.
   3. If seamed, install with no gaps and no overlaps. Install seams vertical and plumb. Horizontal seams are not allowed.
   4. Delay removal of release liner from film until just before each piece of film is cut and ready for installation.
   5. Install film with mounting solution and custom cut to glass with neat, square corners and edges tight to window frame.
   6. Remove air bubbles, wrinkles, blisters and other defects.
   7. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots and pinholes.
      a. Where installed film does not meet this criteria, it shall be removed and replaced with new film.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Remove excess film mounting solution at finished seams, perimeter edges and adjacent surfaces. Use cleaning methods recommended by glazing film manufacturer. Remove and replace films that cannot be cleaned.

END OF SECTION 088000

SECTION 092116 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings, bulkheads, and soffits.

B. Related Requirements:
1. Section 012300 “Alternates” for description of alternates affecting work of this Section.
2. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; ceiling joists. In addition, for all interior soffits and ceilings where span in any direction exceeds 8 feet.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For embossed steel studs and runners and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 or coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners (092116.A01): ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
1. Steel Studs and Runners:
a. Minimum Base-Metal Thickness: 0.0179 inch.
b. Provide 0.0329 inch minimum base metal thickness for studs and runners at walls indicated to receive tile, walls indicated to receive abrasion-resistant drywall, impact-resistant drywall, and at other locations indicated.
c. Depth: 3-5/8 inches, unless otherwise indicated.

2. Embossed Steel Studs and Runners:
   a. Minimum Base-Metal Thickness: 0.0147 inch.
   b. Provide 0.025 inch minimum base metal thickness for studs and runners at walls indicated to receive tile, walls indicated to receive abrasion-resistant drywall, impact-resistant drywall, and at other locations indicated.
   c. Depth: 3-5/8 inches, unless specifically indicated otherwise.

C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit over inside runner and one gauge heavier than gauge for wall construction indicated.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.0329 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels (092116.A02): ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0179 inch.
2. Depth: 1-1/2 inches, unless specifically indicated otherwise.

H. Z-Shaped Furring (092116.A04): With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth as indicated on wall types and sections.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:
1. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E488.
   a. Type: Post installed, chemical anchor or post-installed, expansion anchor.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges. Hot-dip galvanize carrying channels in exterior locations to at least G40 requirements.
1. Depth: 2 inches.

F. Furring Channels (Furring Members) (092116.A05):
   1. Cold-Rolled Channels: 0.053 inch uncoated-steel thickness, with minimum 1/2 inch wide flanges, 3/4 inch deep.
   2. Dimpled Steel Studs and Runners: ASTM C 645
      a. Minimum Base-Metal Thickness: 0.015 inch.
      b. Depth: 2-1/2 inches, unless indicated otherwise.
   3. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
      a. Minimum Base-Metal Thickness: 0.018 inch.
      b. Depth: 2-1/2 inches, unless indicated otherwise.
   4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 1-1/2 inch deep.
      a. Minimum Base-Metal Thickness: 0.0179 inch.

G. Steel blocking and backing strips: Provide metal blocking and backing strips for support and attachment of wall cabinets, toilet accessories, projection screens, wall stops for doors and other items mounted to drywall partitions. Contractor's option to provide one or both of the following types of blocking.
   1. Steel studs not less than 16 ga, cut to fit between studs. Provide a minimum of three (3) at each location blocking is required.
   2. Steel backing strip, not less than 16 ga and 6" high fabricated of galvanized steel.

H. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Vertical Isolation Strips at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.

C. Isolation Strips beneath Runner Tracks at Exterior Walls: Provide the following:
   1. Polyethylene-sheet-backed rubberized asphalt membrane, 40 mils thick. Field cut to match widths of runners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
   2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
   3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Where runner tracks for exterior walls are installed directly against concrete or dissimilar metals, install rubberized asphalt isolation strips between bottom of runner track and concrete.

D. Install studs so flanges within framing system point in same direction.

E. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs, having a minimum base metal thickness of 0.033 inches, at each jamb.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   6. Curved Partitions:
      a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      b. At Contractor's Option, Provide and install premanufactured curved track system or bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      c. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

F. Direct Furring:
   1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

G. Z-Shaped Furring Members:
   1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches o.c.

B. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092116

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior gypsum board (092900.A02 and 092900.A05).
2. Acoustical sealant for sound control assemblies.

B. Related Requirements:
1. Section 012300 “Alternates” for description of alternates effecting work of this Section.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. American Gypsum.
   2. CertainTeed Corp.
   3. Lafarge North America, Inc.
   4. National Gypsum Company
   5. USG Corporation.

B. Abuse/Impact-Resistant Gypsum Board (092900.A05): ASTM C 1629/C 1629M.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
   4. Physical Properties when tested in accordance with ASTM C 1629:
      a. Surface Abrasion Resistance: Level 3.
      b. Indentation Resistance: Level 1, minimum.
      c. Soft-Body Impact Resistance: Level 3.
      d. Hard-Body Impact Resistance: Level 3.

2.4 TRIM ACCESSORIES

A. Interior Trim (092900.A11): ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. L-Bead: L-shaped; exposed long flange receives joint compound.
      c. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      d. Expansion (control) joint.
      e. Wall end cap: Provide “Fast Cap” as manufactured by Trim-Tex Drywall Products.

B. Aluminum Reveal Trim (092900.A13): Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corporation.
      b. Gordon Inc.
      c. Pittcon Industries.
      d. Softforms.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
      a. Provide a paintable mill finish for reveal trim indicated to be painted.
   4. Profiles:
      a. F Trim: Type as indicated on Drawings. Basis-of-Design; Fry Reglet Corp., Model FDM-625-100 or comparable product from listed manufacturers.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
      a. Where specifically indicated on Drawings, provide a setting-type, sandable topping compound for trowel-applied skim coat.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets (092900.A14): ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Joint Sealant (092900.A15): Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Accumetric LLC.; BOSS 824 Acoustical Sound Sealant.
      b. Pecora Corporation.; AIS-919.
      c. USG Corporation.; SHEETROCK Acousitical Sealant.
   2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Acoustical Impaling clips (092900.A14): Galvanized sheet metal impaling clips each with 8 spikes that stick nto the fiberglass and hold the panel in place; 2-1/8” x 1-1/2”; install by either drywall screws or attached with adhesive as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
   4. Where ceilings in showers abut adjacent walls, Provide 1/4- to 3/8-inch-wide spaces and trim edges with plastic edge trim to allow for sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Abuse/Impact-Resistant Type: Vertical and horizontal surfaces of walls, soffits, bulkheads and ceiling surfaces unless otherwise indicated.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. L-Bead: Use where indicated.
   3. U-Bead: Use at exposed panel edges.

D. Interior Trim – Structural Laminate: Provide at all outside corners within 8’-0” of floor surface.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
      a. Primer and its application to surfaces are specified in Other Division 09 Sections.
   3. Level 5: Where indicated on Drawings and at locations behind vinyl film graphic signage, behind areas to receive dry erase paint, and at walls perpendicular to exterior glazing.
      a. Primer and its application to surfaces are specified in Other Division 09 Sections.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Requirements:
   1. Division 26 requirements for electrical connections to illuminated ceiling tile.

1.2 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: One 6 inch square Sample of each type, color, pattern, and texture.
      a. Include all required electrical components for sample of star-field panel ACT6

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling 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. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Size and location of initial access modules for acoustical panels.
   4. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   5. Perimeter moldings.

B. Installer Qualifications: Submit written certification of compliance with requirements.

C. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Furnish two, un-opened boxes of each type installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2 percent of quantity installed.
   4. Impact Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than three years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.

B. Pre-installation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.

B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

E. Metal Suspension System Standard: Comply with ASTM C 635.

2.3 ACOUSTICAL PANELS (095113.A01)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product specified hereinafter or comparable product by one of the following:
   1. Acoustical Ceiling Units:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corp. / Ecophon.
      c. Hunter Douglas.
      d. USG Interiors, Inc.; Subsidiary of USG Corporation.
   2. Metal Suspension Systems, Edge Moldings and Decorative Edge Trim:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corp.
      c. Chicago Metallic Corporation.
      d. Gordon, Inc.
      e. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as specified.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL CEILING PANELS

A. Acoustical Ceiling Panel, (095113.A01 – ACT1): Provide medium textured, humidity resistant, square lay-in, mineral fiber ceiling panels with the following characteristics:
   1. ASTM E 1264 Classification: Type III, Form 1, Pattern E.
   2. Size: 24" x 24" x 3/4".
   3. Color: Refer to Material Finish Legend.
   4. Average light reflectance (LR): 0.86, minimum.
   5. Noise reduction coefficient (NRC): 0.70, minimum.
   6. Ceiling attenuation class (CAC): 35 minimum.
   7. Articulation class (AC): N/A
   8. Flame Spread/Fire Resistance: Class A.
   9. Humidity Resistance: HumiGuard+ or comparable from other listed manufacturers.
   10. Product warranty: 30 years.
   11. Suspension grid type: 15/16.
   12. Basis of Design Product: Provide Armstrong; “Cirrus”, #574 or comparable products from manufacturers listed in Article 2.3 of this Section.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
   1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" in kitchen, serving areas and where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Type: Postinstalled expansion anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type

indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

D. Impact Clips: In all toilet and locker rooms, provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.

E. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For vestibule ceilings adjacent to exterior doors, provide hold-down clips spaced 2'-0" o.c. on all cross-tees for a radius of 10 feet from center of door.

F. Fixture Trim: Provide manufacturer's standard fixture trim for fixtures within the 4 by 4 ceiling panels.
   1. Color to match suspension trim.

2.6 METAL SUSPENSION SYSTEM (095113.A02)

A. Wide-Face, Capped, Double-Web, Steel Suspension System (ACTG1, ACTG3): Main and cross runners roll formed from cold-rolled steel sheet; pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
   1. Structural Classification: Intermediate-duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   3. Face Design: Flat, flush.
   4. Cap Material: Steel or aluminum cold-rolled sheet.
      a. In kitchen and food preparation areas, provide aluminum.
   5. Cap Finish: As indicated on Material Finish Legend
   6. Profile: Prelude XL as indicated on Material Finish Legend.

2.7 METAL EDGE MOLDINGS AND TRIM (095113.A03)

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.8 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requriemetns, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Acoustical Sealant for Concealed Joints:
      a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
      b. Pecora Corporation; AIS-919.
      c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   7. Do not attach hangers to steel deck tabs and steel roof deck. Attach hangers to structural members.
   8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
   1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.

D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. At areas indicated, apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim, unless acceptable to Architect.

F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
3. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For vestibule ceilings adjacent to exterior doors, provide hold-down clips spaced 2'-0" o.c. on all cross-tees for a radius of 10 feet from center of door.
4. Impact Clips: In all toilet rooms, provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.
5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient base (096513.A01).
   2. Resilient molding accessories.

B. Related Requirements:
   1. Section 012300 “Alternates” for alternates effecting work of this Section.
   2. Section 033000 “Cast-in-Place Concrete.”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products 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 or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER BASE (096513.A01)

A. Material Color Schedule designation: Finish “RB1” and “RB2”.
   1. Basis-of-Design Product: Subject to compliance with requirements, Roppe Corporation: “700 Series Wall Base” or comparable product from one of the manufacturers listed below.

2. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
   a. Group: I (solid, homogeneous).
   b. Style: As indicated on Material Finish Legend
   c. Thickness: 0.125 inch.
   d. Height: As indicated on Material Finish Legend
   e. Lengths: Coils in manufacturer's standard length.
   f. Outside Corners: Job formed.
   g. Inside Corners: Job formed.
   h. Colors: As indicated by manufacturer's designations on the Material Finish Legend.

B. Acceptable Manufacturers:
   1. Allstate Rubber Corp.
   2. Armstrong World Industries, Inc.
   3. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   4. Flexco.
   5. Mondo Rubber International, Inc.
   6. Nora Systems, Inc.
   7. Johnsonite Corporation
   8. VPI, LLC, Floor Products Division.

2.2 RUBBER MOLDING ACCESSORY (096513.A06)

A. Description: Rubber cap for cove carpet, cap for cove resilient flooring, carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, and transition strips.

B. Locations: Provide rubber molding accessories in areas indicated.

C. Colors and Patterns: As indicated by manufacturer's designations on Material Finish Legend.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing of Concrete Slabs:
    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
        1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
    b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.

C. Concrete Vapor Sealer Application: Prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install resilient products until they are the same temperature as the space where they are to be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum horizontal surfaces thoroughly.
   3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:
1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.
1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Pattern of installation.
3. Pattern type, location, and direction.
4. Carpet tile type, color and dye lot.
5. Type, color and location of insets and borders.
6. Type, color and location of edge, transition and other accessory strips.
7. Transition details to other flooring materials.

A. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.

B. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Furnish one un-opened box of each carpet tile type, color and pattern for every 5 percent of amount installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups/Field Samples: Build mockups/field samples to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups/field samples for carpet tile including accessories.
      a. Size: Minimum 50 sq. ft. for each type, color, and pattern in locations directed by Architect.
   2. Approval of mockups/field samples does not constitute approval of deviations from the Contract Documents contained in mockups/field samples unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (096813.A01)

A. Basis-of-Design Product: Subject to compliance with requirements, provide products specified on drawings or a comparable products meeting specified requirements, having similar colors and patterns as acceptable to Architect with the following characteristics submitted to and accepted by Architect prior to bidding.

1. Refer to Finish Legend for carpet selections including name, manufacturer, and installation pattern.

B. Carpet Type C1, C2, and C3: Subject to compliance with requirements, provide "Linewave #04846" by Tandus Centiva
   1. Product Construction: Patterned Loop
   2. Fiber Type: 100 percent Recycled Content Type 6 Nylon
   3. Face Weight: 20 oz/sy
   4. Pile Thickness: 0.187 inches
   5. Total Thickness: 0.247 inches
   6. Stiches: 10.0 per inch
   7. Radiant Panel: ASTM E-648 Class 1.
   8. Smoke Density: ASTM E-662 $\leq$ 450.
   9. Primary Backing: Synthetic – GlasBac
   10. Soil / Stain Protection: Manufacturer's standard with warranty.
   11. Color and Pattern: As indicated on Material Finish Legend.
   12. Installation Method: As indicated on Material Finish Legend.

C. Carpet Type C4: Subject to compliance with requirements, provide "Walk Right In II" by Patcraft
   1. Product Construction: Needlebond Hobnail.
   2. Fiber Type: Polyester.
   3. Yarn Weight: 49.3 oz/yd
   4. Pile Density: 6477 oz/yd.
   5. Stiches: 11.0 per inch.
   6. Radiant Panel: ASTM E-648 Class 1.
   7. Smoke Density: ASTM E-662 $\leq$ 450.
   8. Primary Backing: Woven Synthetic.
   9. Secondary Backing: Ecoworx Tile
   10. Soil / Stain Protection: Manufacturer's standard with warranty.
   11. Color and Pattern: As indicated on Material Finish Legend.
   12. Installation Method: As indicated on Material Finish Legend.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with anodize aluminum finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

D. Topical Concrete Vapor Sealer: Liquid penetrating type or film-forming type, designed to seal concrete and inhibit moisture transmission through slab. Concrete vapor sealers shall be as recommended by tile carpeting Contractor based upon successful previous installations and as acceptable to tile carpeting manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by carpet tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing of Existing Slabs:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
         1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
      b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.

E. Concrete Vapor Sealer Application: When concrete vapor sealer is required, prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method:
   1. At perimeter of each room/area: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
   2. In field of room/area (inside glued down perimeter): install tiles with factory-applied releasable, pressure-sensitive adhesive strips.

C. Installation Layout: As indicated on Material Finish Legend.

D. Maintain dye lot integrity. Do not mix dye lots in same area.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

H. Install pattern parallel to walls and borders.

I. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

J. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

K. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete masonry units (CMU).
   2. Steel.
   3. Steel doors and frames.

B. Related Requirements:
   1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
   2. Section 099600 “High Performance Coatings” for special-use coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: Where colors are not indicated on Drawings, submit for each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 6 inches square.
   2. Label each coat of each Sample.

D. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. VOC content.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: Two (2) gallons of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products The Sherwin-Williams Company, or comparable products from one of the following:
   1. Benjamin Moore & Co.
   2. Glidden Professional.
   3. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

C. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.

D. Paint Systems: Refer to schedule at end of this Section.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Masonry (Clay and CMU): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
   3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
   4. Paint entire exposed surface of window frames and sashes.
      a. Do not paint pre-finished and anodized aluminum surfaces.
   5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. CMU Substrates:
1. 1 coat Loxon Conditioner, A24-100 Series; apply at a rate of 250 sq. ft. per gallon.
2. 2 coats Loxon Masonry Topcoat, A24 Series; apply at a rate of not less than 200 sq. ft. per gallon.

B. Steel Substrates - Unprimed:
1. 1 coat Kem Kromik Metal Primer.
2. 2 coats Industrial Enamel B54Z Series, 5 mils wet, 2.5 mils dry per coat (gloss modified to satin).

C. Steel Substrates - Primed:
1. 2 coats Industrial Enamel B54Z Series, 5 mils wet, 2.5 mils dry per coat (gloss modified to satin).

D. Steel Substrates – Galvanized (except handrails and guardrails):
1. 1 coat Galvite HS, 3 to 4.5 mils dft.
2. 2 coats Industrial Enamel B54Z Series, 5 mils wet, 2.5 mils dry per coat (gloss modified to satin)..

E. Steel Substrates – Galvanized Steel Handrails and Guardrails (where railings are indicated to be painted):
1. 1 coat re-coatable epoxy primer.
2. 2 coats Acrylon 218 HS acrylic polyurethane, gloss.

F. Aluminum Substrates:
1. 2 coats Resilience Exterior Latex, satin.

G. Primed Steel Doors and Frames:
1. 1 touchup coat of ProCryl Universal Water-Based Primer.
2. 2 coats Industrial Urethane-Alkyd-Enamel, semi-gloss.

3.7 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Portland Cement Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.8 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.9 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.10 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of opaque paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Galvanized metal.
   5. Aluminum (not anodized or otherwise coated).
   6. Gypsum board.

B. Related Requirements:
   1. Section 012300 “Alternates” for alternates on items affecting the work of this section.
   2. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   4. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
   5. Section 099300 “Staining and Transparent Finishing” for transparent finishes on wood substrates.
   6. Section 099600 “High Performance Coatings” for special-use coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 6 inches square.
   2. Label each coat of each Sample.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. VOC content.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: One (1) gallon of each material and color applied.

1.4 QUALITY ASSURANCE

A. Mockups/Field Samples: Apply mockups/field samples of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups/field samples.
      a. If preliminary color selections are not approved, apply additional field samples of additional colors selected by Architect at no added cost to Owner.
   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. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products scheduled by The Sherwin-Williams Company, unless specified otherwise, or comparable products of one of the following:
   1. Benjamin Moore & Co.
   2. Glidden Professional.
   3. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range, matching Sherwin Williams, Benjamin Moore & Co.; and Wolf Gordon colors.
   1. 20 percent of surface area will be painted with deep tones.

C. Material Finish Schedule designations: “P1” through “P5”.
   1. Provide “flat” sheen for ceilings, unless otherwise specified.
   2. Provide “eggshell” sheen for walls, unless otherwise specified.
   3. Provide dry-erase paint in color and sheen as specified later in this section. (DEP).
   4. Provide dryfall paint as specified in this section. (DFP1, DFP2).

D. Paint Systems: Refer to schedule at end of this Section.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound and gypsum veneer plaster is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
1. Primer concrete surfaces indicated/scheduled to receive textured woven glass-fiber wall covering.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Existing Substrates: Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Prepare substrates in accordance with paint manufacturer's recommendations to ensure adhesion.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
   6. Paint exposed air diffusers and grilles same color as adjacent wall finish.
   7. Mask off surfaces of doors prior to painting vision lite frames. Clean any excess paint from door surface to so that there is no evidence of excess paint remaining on door face and glass.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Other items as directed by Architect.
   2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Wall Surfaces - Latex System:
1. 1 coat ProMar 200 Zero VOC Interior Primer.
2. 2 coats ProMar 200 Zero VOC Latex, eggshell.

B. CMU Substrates - Latex System:
1. 1 coat PrepRite Block Filler.
2. 2 coats ProMar 200 Zero VOC Latex, eggshell.

C. CMU Substrates – Epoxy System: Refer to Section 099600.

D. Steel Substrates – Non-primed:
1. 1 coat Pro Industrial Pro-Cryl Universal Primer.
2. 2 coats Pro Industrial Multi-Surface Acrylic (gloss modified to semi-gloss).

E. Steel Substrates – Pre-primed:
1. 1 touchup coat Pro Industrial Pro-Cryl Universal Primer.
2. 2 coats Pro Industrial Multi-Surface Acrylic (gloss modified to semi-gloss).

F. Steel Hollow Metal Doors and Frames (including doors, frames, metal glass stops, vision lite frames, astragals and metal louvers):
1. 1 touchup coat Pro Industrial Pro-Cryl Universal Primer.
2. 2 coats Pro Industrial Multi-Surface Acrylic (gloss modified to semi-gloss).

G. Steel Substrates (exposed metal decking, bar joists and exposed over-head structure) - Dryfall:
1. 2 coats Waterborne Acrylic Dryfall, eggshell.

H. Galvanized-Metal Substrates (where not specifically indicated to be painted):
1. 1 coat Pro Industrial Pro-Cryl Universal Primer.
2. 2 coats Pro Industrial Multi-Surface Acrylic (gloss modified to semi-gloss).

I. Galvanized-Metal Ductwork Substrates:
1. 1 coat Pro Industrial Pro-Cryl Universal Primer.
2. 2 coats Waterborne Acrylic Dryfall, eggshell.

J. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. 2 coats A-100, flat.

K. Gypsum Board Wall Substrates - Latex:
1. 1 coat ProMar Interior Latex Primer.
2. 2 coats ProMar 200 Zero VOC Latex, eggshell.

L. Gypsum Board Ceiling Substrates - Latex:
1. 1 coat ProMar Zero VOC Interior Primer.
2. 2 coats ProMar 200 Zero VOC Latex, flat.

M. Gypsum Board Wall Substrates – Epoxy: Refer to Section 099600.

N. Gypsum Board Wall and Ceiling Substrates indicated to receive Wall Covering – prepare per the wallcovering manufacturer's printed recommendations:

O. Clear Dry-Erase Paint on Painted Surfaces (099123.A06 – DEP):
   1. Basis of Design Product: "Wink on Color", as manufactured by Wolf Gordon or comparable product from other manufacturers meeting specified requirements and which are submitted to and accepted by Architect prior to bidding.
      a. Install touch-up coat primer and 2 coats acrylic paint as noted above for surface indicated on drawings.
      b. As noted on Material Finish Schedule provide paint color as noted before applying clear coat of dry erase coating.
   2. 1 coat "Wink" 2-part water-based dry erase coating by Wolf Gordon, install as recommended by manufacturer for warranted system.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood finishes.

B. Related Requirements:
1. Section 099113 "Exterior Painting" for standard paint systems on exterior substrates.
2. Section 099123 "Interior Painting" for standard paint systems on interior substrates.

1.2 DEFINITIONS

A. Gloss Level 3 “Eggshell”: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 4 “Satin-like”: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 5 “Semi-gloss”: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.
1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long. Apply finish to half of sample.
2. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Stains and Transparent Finishes: 1 gallon of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 50 sq. ft.
   b. Other Items: Architect will designate items or areas required.
2. Final approval of stain color selections will be based on mockups.
   a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. Glidden Professional.
   3. PPG Architectural Finishes, Inc.
   4. Pratt & Lambert.
   5. Sherwin-Williams Company (The).

B. Basis-of-Design Products: Subject to compliance with requirements, provide products from Sherwin-Williams or comparable products from other manufacturers listed.

2.2 MATERIALS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
   3. To the best extent possible, provide products from a single manufacturer.

B. Stain Colors: As selected by Architect from manufacturer's full range.

2.3 WOOD FILLERS

A. Wood Filler Paste: MPI #91, as recommended by topcoat manufacturer.

2.4 STAINS

A. Stain, Interior:
   1. WoodClassics 250 or Minwax 250 Wood Stain.

2.5 POLYURETHANE VARNISHES

A. Varnish, Interior, Polyurethane, Oil-Modified, Satin (Gloss Level 4):
   1. WoodClassics Polyurethane Varnish.

B. Varnish, Interior, Polyurethane, Waterborne, Satin (Gloss Level 4):
   1. WoodClassics Waterborne Polyurethane Varnish.

2.6 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.
   1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
   1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
   2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view and dust off.
   3. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   4. Seal back sides and non-exposed surfaces of wood trim.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.
   1. Use applicators and techniques suited for finish and substrate indicated.
   2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
   3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

4. Finish back sides of interior veneered plywood same as faces where indicated to be installed over concrete.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
1. Protect finished horizontal traffic surfaces from foot traffic for not less than 72 hours after final application.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Stained Millwork:
1. 1 coat stain.
2. 2 coats polyurethane varnish.

B. Wood substrates, non-traffic vertical surfaces:
1. 1 coat stain.
2. 2 coats polyurethane varnish.

C. Wood substrates, traffic and non-traffic horizontal surfaces:
1. 1 coat stain.
2. 1 intermediate coat (thinned to 10 percent reduction) polyurethane varnish.
3. 2 topcoats polyurethane varnish.

D. Wood substrates, nontraffic and traffic horizontal surfaces of Learning Stair and Benches:
1. General: Finish shall be a complete system from a single manufacturer.
2. Apply 3 coats of sealer.
3. Apply 2 coats of topcoat.

END OF SECTION 099300

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of high-performance coating systems (099600.A01) on the following substrates:
   1. Exterior exposed structural and miscellaneous steel, including bollards and railings.
   2. Interior exposed structural and miscellaneous steel, including bollards and railings.
   3. Interior concrete and masonry block.
   4. Interior gypsum drywall partitions.

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
   2. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
   3. Section 099113 "Exterior Painting" for special-use coatings and general field painting.
   4. Section 099123 "Interior Painting" for special-use coatings and general field painting.
   5. Section 099300 “Staining and Transparent Finishing”.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. VOC content.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Coatings: One (1) gallon of each material and color applied.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
      a. Pipe and Tube Railings: Paint at one section of railing.
      b. Exterior Steel Substrates: Provide sample of at least 25 sq. ft.
      c. Wall and Ceiling Surfaces: Provide samples of at least 50 sq. ft.
      d. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   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. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
   1. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   2. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer and Products: Subject to compliance with requirements, provide products of The Sherwin-Williams Company as set forth hereinafter or comparable products by one of the following:
   1. Benjamin Moore & Co.
   2. Glidden Professional.
   3. PPG Architectural Finishes, Inc.
   4. Tnemec, Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
   3. Provide products of same manufacturer for each coat in a coating system.

B. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.

C. Paint Systems: Refer to schedule at end of this Section.

D. Material Finish Schedule designations: “P1” through “P5”.
   1. Provide colors and sheens as indicated on Material Finish Legend on Drawings.
   2. Paint bollards and railings in “Safety Yellow” as acceptable per Owner and Architect.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
   1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Gypsum Board: 12 percent.
      d. Wood: 15 percent.

B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
   1. Prepare previously painted surfaces indicated to receive new paint finish in strict accordance with paint manufacturer's written recommendations.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.

E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations.
   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
1. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Galvanized Metal Bollards:
1. 1 coat Macropoxy 646
2. 1 coat Acrolon 218 HS Polyester Acrylic Polyurethane, semigloss.

B. Structural and Miscellaneous Steel:
1. 1 primer coat of Tnemec Series 161 Tneme-Fascure, polyamide epoxy, 7 mils wet, 4 mils dry.
2. 1 epoxy intermediate coat or scarification is required if prime coat is exposed to exterior weather for more than three (3) weeks.
3. 1 topcoat of Tnemec Series 750, Endura-Shield, aliphatic polyester polyurethane, 3 mils wet, 1.5 mils dry, spray applied.
4. Note: Number of coats may need to be increased to provide specified DFT and to achieve uniform coverage and hiding

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Exposed Structural Steel Columns and Framing:
1. 1 coat Sherwin Williams Macropoxy 646.
2. 2 coats Acrolon 218 HS Acrylic Polyurethane, semi-gloss.

B. Concrete and CMU Substrates - Epoxy System (other than wet walls):
1. 1 coat Loxon Block Surfacer, 18 mils wet, 8 mils dry.
2. 2 coats Pro Industrial Pre-Catalyzed Water Based Epoxy, single-component, eggshell.

C. Concrete and CMU Substrates - Epoxy System (wet walls):
   1. 1 coat KemCati Kote High Solids Epoxy Filler/Sealer.
   2. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component, eggshell.

D. Gypsum Board Wall Substrates - Epoxy:
   1. 1 coat ProMar 200 Zero VOC Interior Primer.
   2. 2 coats Pro Industrial Pre-Catalyzed Water Based Epoxy, single-component, eggshell.

E. Gypsum Board Wall Substrates – Epoxy (wet walls):
   1. 1 coat ProMar 200 Zero VOC Interior Primer.
   2. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component, eggshell.

F. Gypsum Board Ceiling Substrates – Epoxy (wet walls):
   1. 1 coat Sherwin Williams Macropoxy 646.
   2. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component, eggshell.

END OF SECTION 099600

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-polymer toilet compartments configured as toilet enclosures (102113.A01).
   2. Solid-polymer urinal screens (102113.A02).

B. Related Sections:
   1. Section 061000 "Rough Carpentry" for blocking.
   2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, and similar accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments and urinal screens. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of centerlines of toilet fixtures.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of compartment material involving texture and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
   1. Each type of material, color, texture, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 75 or less.
   2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221.

C. Brass Castings: ASTM B 584.

D. Brass Extrusions: ASTM B 455.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

F. Stainless-Steel Castings: ASTM A 743/A 743M.

2.2 SOLID-POLYMER UNITS (TC1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide General Partitions., High Density Polymer toilet enclosure units or comparable product by one of the following:
1. Accurate Partitions Corporation.
2. Bradley Corporation; Mills Partitions.
3. Comtec Industries/Capitol Partitions.
4. Metpar Corp.
5. Knickerbocker Partition Corporation.
6. Partition Systems Incorporated of South Carolina.
7. Santana Products, Inc.

B. Toilet-Enclosure Style: Floor-mounted overhead braced.

C. Urinal-Screen Style: Wall mounted with continuous brackets.

D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
2. Color and Texture Pattern: As indicated on Drawings, where not specifically indicated, as selected by Architect from full range of manufacturer’s standard colors.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum or stainless steel.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Material: Clear-anodized aluminum or stainless steel.
2. Hinges: Provide 8-inch, “wrap-around” hinges fabricated from aluminum in a bright anodized finish. Hinges shall have field adjustment capability. Hinge shall be self-closing to within 15 degrees of opening. Mount with through-bolts.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Intent is to match existing.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Floor-Mounted Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
   2. Stirrup Brackets: Secure panels to walls and to pilasters with continuous brackets.
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach screens to pilasters and walls with continuous brackets and anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102219 – INTERIOR CHAIN LINK PARTITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior Chain-link Partitions.
   2. Swing Gates

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
   1. Fence and gate posts, rails, and fittings.
   2. Chain-link fabric, reinforcements, and attachments.
   3. Gates and hardware.
   4. Include illustration A (plan view) of chain link partition layout and gates(s) location.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link partition and gate, from manufacturer.

B. Product Test Reports: For framing strength according to ASTM F 1043.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
   1. Gate hardware.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: **5** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
   1. Fabric Height: As indicated on Drawings.
   2. Steel Wire Fabric: Wire with a diameter of 0.120 inch (11 gauge)
      a. Mesh Size: 2 inches.
      b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
   3. Selvage: Knuckled at both selvages

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
   1. Fence Height: As indicated on Drawings
   2. Heavy Industrial Strength: Material: Group IA, round steel pipe, Schedule 40.
      a. End, Corner and Line Post: 1.9 inches in diameter
   3. Horizontal Framework Members: Top and bottom rails complying with ASTM F 1043.
      a. Top Rail: 1.66 inches in diameter.
   4. Metallic Coating for Steel Framing:
      a. Type A, consisting of not less than minimum 1.8-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.

2.3 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types
   1. Gate Leaf Width: 4 feet, each leaf
   2. Gate Fabric Height: 7 feet

B. Pipe and Tubing:
   1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing
   2. Gate Posts: Round tubular steel.
   3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Assembled with corner fittings.

D. Gate Construction: Fully Welded

E. Hardware:
   1. Hinges: 180-degree outward swing.
   2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.4 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
      a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
   2. Post-Installed Anchors: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
      a. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S325, Group VIII (anchors, expansion, nondrilling), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.

G. Floor Flanges: Provide fence manufacturer's standard heavy base flanges for anchoring posts to concrete slab. Flanges shall have holes for post installed expansion anchors. Flanges shall be threaded to receive 3 to 4 posts or capable of welding posts to flange connection. Flanges shall be same material and coating as frame work.

H. Finish:
1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Layout locations of partition posts, and gates.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Setting: Set posts welded to or threaded into floor flange and expansion anchor to slab.
1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

B. Line Posts: Space line posts uniformly at 8 feet o.c.

C. Top and Bottom Rails: Install and secure to posts with fittings.

D. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 4 inches between slab and bottom selvage unless otherwise indicated. Leave 4 inches between ceiling and top selvage. Pull fabric taut and tie to posts, and rails. Anchor to framework so fabric remains taught.

E. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

F. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 102219

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless Steel Corner Guards (102600.A03)

B. Related Sections:
   1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of corner guard.

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Corner Guards: 6 inches long.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 01 40 00 "Quality Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.
   3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
      a. Store corner-guard covers in a vertical position.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fasteners: Nonmagnetic stainless-steel metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 STAINLESS STEEL CORNER GUARDS (102600.A03)

A. Surface-Mounted, Stainless Steel Corner Guards (102600.A03): ASTM A240, Type 304, 16 gauge with #4 satin finish

B. Basis-of-Design Product: Provide Model 2330 Stainless Steel Corner Guard by Wallguard or approved product with the following characteristics.
   1. Description: 3 ½" x 3 ½" x 90 degree surface mounted stainless steel corner guard with 1/8" radius corner.
   2. Mechanical Fasteners: Stainless steel #6 x 1-1/2" countersunk sheet metal screws
   3. Adhesive: Model ADH-50 low VOC polyurethane based construction adhesive
   4. Height: 8 feet above finished floor.

2.3 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Provide surfaces free of chips, dents, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION AND CLEANING

A. General: Install impact-resistant wall protection units plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Immediately after completion of installation, clean plastic covers and accessories as recommended by corner guard manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Underlavatory guards.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
   1. Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   2. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Protect items from physical damage and from becoming wet, soiled, scratched and from construction operations. Comply with manufacturer’s recommendations for handling, storage and protection before, during and after installation.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser – (102800.A01):
1. Basis-of-Design Product: Bobrick B-4288 Multi-Roll.
2. Mounting: Surface.
3. Door or Cover: Door with flush tumbler lockset.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

B. Paper Towel (Roll) Dispenser – (102800.A02):
1. Basis-of-Design Product: Georgia Pacific Vista 54338.
2. Mounting: Surface.
3. Operation: Push paddle with 8" diameter paper roll.
4. Material and Finish: High density plastic.

C. Liquid-Soap Dispenser – (102800.A05):
1. Basis-of-Design Product: Spartan Lite'n Foamy Dispenser #975600 with lock.
2. Description: Designed for dispensing foaming soap.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 1,000 mL.
5. Refill Indicator: Window type.

D. Grab Bar (102800.A06):
1. Basis of Design Product: Bobrick Washroom Equipment, Inc.; B-6806 Series.
   a. Bobrick; B-6806.
   b. Bradley; 8122.
   c. ASI; 3201P.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length:
   a. Straight, 36 inches long behind accessible toilets.
   b. Straight, 42 inches long to side of accessible toilets.
   c. Straight, 18 inches long vertical, above and to front of 42 inch grab bar at side of accessible toilets.

E. Mirror Unit (102800.A10):
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-290 Series.
   a. Bobrick; B-2908 (tempered) and B-290 (non-tempered).
   b. Bradley; 780-2 (tempered) and 780 (non-tempered).
   c. ASI; 0600-B (tempered) and 0600 (non-tempered).

2. Frame: Stainless-steel channel, in No.4 satin finish.
   a. Corners: Manufacturer's standard, mitered.
3. Glazing: Provide polished tempered glass mirror in locker rooms and gym facilities. Provide polished non-tempered glass mirror in other locations unless noted otherwise.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
5. Sizes: As indicated on Drawings.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard (102800.A21):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Plumberex Specialty Products, Inc.
   b. Truebro by IPS Corporation.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION, ADJUSTING AND CLEANING

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
1. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. JL Industries, Inc.; a division of the Activar Construction Products Group.
      b. Larsens Manufacturing Company.
      c. Potter Roemer LLC.
   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Wet-Chemical Type (104416.A02) Bracket Mounted: UL-rated 2-A:1-B:C:K, 1.6 gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container, with pressure indicating gage.

C. Multipurpose Dry-Chemical Type (104416.A01): UL-rated 3-A:40-B:C nominal capacity, with mono-ammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 48 inches above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 111300 - LOADING DOCK BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes loading dock bumpers (111300.A01).

1.2 ACTION SUBMITTALS

A. Product Data: For each type of loading dock bumper.

B. Shop Drawings: For dock bumpers. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 DOCK BUMPERS (111300.A01)

A. General: Surface-mounted bumpers; of type, size, and construction indicated; designed to absorb kinetic energy and minimize damage to loading dock structure.

B. Molded-Rubber Dock Bumpers: Fabricated from molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240; of size and configuration indicated. Fabricate units with not less than two predrilled anchor holes.
   1. Configuration: Rectangular.
   2. Thickness: 4 inches.

C. Anchorage Devices: Galvanized-steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.

D. Materials: ASTM 36/A 36M for steel plates, shapes, and bars. Hot-dip galvanize according to ASTM A 123/A 123M.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.
   1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.
   2. Screw Attachment: Attach dock bumpers to wood construction with lag bolts as indicated.

3.3 ADJUSTING

A. After completing installation of exposed, factory-finished dock bumpers, inspect exposed finishes and repair damaged finishes.

END OF SECTION 111300

SECTION 122113 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Horizontal louver blinds with aluminum slats.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, special feature descriptions and operating instructions.

B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds, including: elevations, sections, details and dimensions not sown in Product Data. Show installation details, mountings, attachments to other work/adjacent construction and operational clearances.

C. Samples for Initial Selection: For each type and color of horizontal louver blind indicated.
   1. Include similar Samples of accessories involving color selection.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include precautions for cleaning materials and methods that may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Flame-Resistance Ratings: Passes NFPA 701.

C. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer and product name, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

B. Store materials off ground in dry enclosed space and under cover.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

A. Submit written guarantee for louver blinds covering workmanship and materials, signed jointly by manufacturer and installer.
   1. Louver blind shall have a Life Time warranty.

PART 2 - PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS (122113.A01)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Levolor, a Newell Rubbermaid Company; Riviera Classic 1" Blind, Model RIV1 or a comparable product by one of the following:
   1. Hunter Douglas.
   2. Springs Window Fashions Division, Inc.

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
   1. Width: 1 inch.
      a. Spacing: 21 mm.
   2. Thickness: Not less than 0.008 inch.
   3. Finish: One color, similar to clear anodized aluminum.
      a. Ionized Coating: Antistatic, dust-repellent, baked polyester finish.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and end plugs and the following:
   1. Capacity: One blind per headrail.

D. Bottom Rail: Formed-steel or extruded-aluminum tube, with plastic or metal capped ends top contoured to match crowned shape of slat; with enclosed ladders and tapes to prevent contact with sill.

E. Ladders: Evenly spaced to prevent long-term slat sag.
   1. For Blinds with Nominal Slat Width 1 Inchor Less: Braided string.
   2. Ladders shall be dyed to match slat color or be a complimentary color acceptable to Architect.

F. Lift Cords: Manufacturer’s standard.

G. Tilt Control: Enclosed worm-gear mechanism, slip clutch or detachable wand preventing over-rotation, and linkage rod, and the following:
   1. Tilt Operation: Manual with clear plastic wand.
   2. Length of Tilt Control: Manufacturer's standard.
   3. Tilt: Full.

H. Lift Operation: Manual, with low-friction cord locking mechanism. Mechanism shall be “crash-proof” type and shall lock automatically upon release of cord.
   1. Provide blinds with “top lock” cord lock so that blinds have two positions; fully raised or fully down.
   2. Provide blinds with “ring pulls” in lieu of tassels. Provide with cord of adequate length so that bottom of ring pull is 5’-4” above finished floor. Where headrail is below 6’-0” above finished floor, provide 4” cord length.

I. Tilt-Control and Cord-Lock Position: Right and left side of headrail, respectively, unless otherwise indicated.

J. Valance: Manufacturer's standard.
   1. Finish Color Characteristics: Match color, texture, pattern, and gloss of slats.

K. Mounting: Wall mounting between jambs, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
   1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind. Mounting brackets and accessories shall be colored to match headrail/valance.
   2. Provide receiver clip on bottom of blinds to secure bottom of blind to sill substrate.

L. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range.

2.2 HORIZONTAL LOUVER BLIND FABRICATION

A. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.
   1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Blind Units Installed between (inside) Jambs: Width equal to 1/4 inchper side or 1/2 inchtotal, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.
   2. Blind Units Installed outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:
   1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

F. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior slat edges in any position are not closer than 2 inches to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware if any.

B. Jamb Mounted: Install headrail recessed into opening to within 1/2 inch of window frame and flush to head of opening.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.

B. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

D. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122113

SECTION 123200 - MANUFACTURED WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic-laminate-faced wood cabinets of stock design (123200.A01).
2. Plastic-laminate countertops (123200.A03).
3. Solid surface countertops (123200.A04).

B. Related Sections:
1. Section 061000 "Rough Carpentry" for wood blocking for anchoring manufactured wood casework.
2. Section 064023 "Interior Architectural Woodwork" for custom plastic-laminate-clad casework.
3. Section 092116 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring manufactured wood casework.
4. Section 096513 "Resilient Base and Accessories" for resilient base applied to manufactured wood casework.

1.2 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and surfaces visible in open cabinets.

C. Semiexposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semiexposed.

D. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware and keying of locks. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.
1. Indicate types and sizes of cabinets and countertops, in addition to any field joints.
2. Indicate locations and types of service fittings for science casework.
3. Indicate locations of blocking and reinforcements required for installing casework.
4. Include details of utility spaces showing supports for conduits and piping.
5. Include details of exposed conduits, if required, for service fittings.
6. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other equipment.

C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples for Initial Selection: For cabinet finishes and for each type of top material indicated.

E. Samples for Verification: 8-by-10-inch Samples for each type of finish, including top material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

1.5 CLOSEOUT SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer with not less than seven years of successful experience, under the current company name, in producing manufactured casework similar to that required for this Project.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Source Limitations: Obtain manufactured wood casework from single source from single manufacturer.

D. Quality Standard: Unless otherwise indicated, comply with requirements for modular cabinets in AWI's "Architectural Woodwork Quality Standards" for “Custom” grade.

E. Product Designations: Drawings indicate sizes, configurations, and finish material of manufactured wood casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish material, and complying with the Specifications may be considered. Refer to Division 01 Section "Product Requirements."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

B. Deliver solid surface, and quartz countertops only after casework has been completed in installation areas.

C. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install manufactured wood casework until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings 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.

B. Field Measurements: Verify actual dimensions of construction contiguous with manufactured wood casework by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate layout and installation of framing and reinforcements in walls and partitions for support of manufactured wood casework.

B. Preinstallation Conference: Conduct conference at Project site.

C. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Delamination of components or other failures of glue bond.
      b. Warping of components.
      c. Failure of operating hardware.
      d. Deterioration of finishes.
   2. Warranty Period: Five years 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, except where specifically specified otherwise:
   1. Plastic-Laminate-Faced Manufactured Casework:
      a. Hamilton Laboratory Solutions
      b. Case Systems Inc.
      c. LSI Corporation of America; a Sagas International company.
      d. Precision Craft.
      e. Stevens Industries, Inc.
      f. TMI Systems Design Corporation.

2.2 MATERIALS, GENERAL

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Softwood Plywood: DOC PS 1.

C. Particleboard: ANSI A208.1, Grade M-2.

D. MDF: ANSI A208.2, Grade 130.

E. Plywood for Countertops: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

F. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
   1. Refer to Drawings for laminate selections.
      a. Comparable products from other manufacturers will be considered which match colors and patterns to Architect's satisfaction (submit samples) and which are submitted to and accepted by Architect prior to bidding.

G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Basis of Design Products: Subject to compliance with requirements, provide products by manufactuers indicated on Material Finish Legend on drawings or comparable product submitted to and accepted by Architect prior to bidding.
   2. Colors and Patterns: As indicated Material Finish Legend on Drawings.

H. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

I. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.

J. Edgebanding for Thermoset Decorative Panels: PVC or polyester edge banding complying with LMA EDG-1 and matching thermoset decorative panels.

K. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, suitable for exposed applications.

L. Sealant for Countertops and Sills: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 07 92 00 "Joint Sealants."
   1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
      a. Color: As selected by Architect from manufacturer's full range.

2.3 CABINET MATERIALS

A. Exposed Cabinet Materials:
   1. Plastic Laminate: Grade VGS.
   2. Unless otherwise indicated, provide specified edge banding on all exposed edges.

B. Semi-exposed Cabinet Materials:
   1. Plastic Laminate: Grade VGS.
      a. Provide plastic laminate for semi-exposed surfaces unless otherwise indicated.
   2. Metal for Steel Drawer Pans: Cold-rolled, steel sheet.
   3. Unless otherwise indicated, provide specified edge banding on all semi-exposed edges.

C. Concealed Cabinet Materials:
   1. Plastic Laminate: Grade BKL.

2.4 DESIGN, COLOR, AND FINISH

A. Design: Provide manufactured wood casework of the following design:
   1. Flush overlay with wire pulls.

B. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.

C. Plastic-Laminate Colors, Patterns, and Finishes: As indicated on Material Finish Legend.

D. PVC Edgebanding Color: As indicated on Material Finish Legend.

2.5 CABINET FABRICATION

A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
   1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
   2. Shelves: 3/4-inch up to 36 inch spans and 1-inch for spans greater than 36 inches, thermoset decorative panels.
   3. Backs of Cabinets: 1/2-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
   4. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced.
   5. Drawer Sides and Backs:
      a. 1/2-inch solid-wood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
      b. 1/2-inch, high density fiberboard, 55 pcf density minimum. All parts glued and mechanically fastened using thermosetting fasteners.
   6. Drawer Bottoms: 1/4-inch thermoset decorative panels glued and dadoed into front, back, and sides of drawers. Use 1/2-inch material for drawers more than 24 inches wide.
   7. Drawer Bodies: Steel drawer pans formed from 0.0359-inch- thick metal, metallic phosphate treated, and finished with manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil for topcoat and 2 mils for system.
   8. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced.
   9. Stiles and Rails of Glazed Doors More Than 48 Inches High: 1-1/16-inch- thick, with solid-wood cores.
   10. Cabinets Bases: Bases shall be fabricated separate from cabinets (not integral). Fabricate from ¾-inch exterior grade, preservative treated plywood or preservative-treated 2x4's. Fabricate in a ladder configuration with plywood fronts and back running continuous for the length of the cabinet. Provide ends, and provide additional runners centered in all cabinets greater than 24 inches wide.

B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

2.6 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish , commercial-quality, heavy-duty hardware.
1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Chrome-plated, semiconcealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and hospital tips. Provide 2 hinges for doors less than 48 inches high and 3 hinges for doors more than 48 inches high.

C. Pulls: Solid aluminum wire pulls, fastened from back with two screws. Provide 2 pulls for drawers more than 24 inches wide.

D. Door Catches: Zinc-plated, dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches high.

E. Drawer Slides: BHMA A156.9, Type B05091.
1. Standard Duty (Grades 1, 2, and 3): Side mounted and extending under bottom edge of drawer; full -extension type; zinc-plated steel with polymer rollers.
2. Box Drawer Slides: Grade 1, for drawers not more than 6 inches high and 24 inches wide.
3. File and Flat-File Drawer Slides: Grade 1HD-200, for drawers more than 6 inches high or 24 inches wide.

F. Drawer and Hinged Door Locks: Cylindrical (cam) type, 5-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.
1. Provide a minimum of two keys per lock and six master keys.
2. Provide locks where indicated.

G. Adjustable Shelf Supports: 2-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013.

H. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Color as selected by Architect from manufacturer’s full range.

I. Coat Hooks (123200.A19): Cast aluminum with A14, bright nickel finish. Provide double wardrobe hook, similar to Ives #582.

2.7 PLASTIC LAMINATE-CLAD COUNTERTOPS

A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.

B. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded to both sides of 1-1/8-inch plywood or particleboard. Sand surfaces to which plastic laminate is to be bonded.
1. Plastic Laminate for Flat Tops: Grade HGS.
2. Plastic Laminate for Backing: Grade BKL.
3. Provide 3-mm PVC edging on front edge of top, on top edges of backsplashes and end splashes, and on ends of tops and splashes.
4. Provide separate plastic-laminate-clad, topset, backsplashes and end splashes fitted to top.
5. Use exterior medium density fiberboard or exterior glue particleboard for countertops containing sinks.

2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS (123200.A04)

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 1/2 inch.

C. Colors, Patterns, and Finishes: Counter tops, splashes, aprons and undercounter panels shall be of the same material and color. Architect may select a separate color for each room. Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. As indicated by manufacturer's designations indicated on Material Finish Legend

D. Fasteners: Provide non-corrosive fasteners as required for complete installation of components and assemblies. Type and size shall be as required for conditions, materials and superimposed loads involved.

E. Accessories: Comply with manufacturer's recommendations for hardware, non-corrosive fasteners, adhesives, sealers, fabrication and finishing.

F. Fabricate in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate with shop-applied edges of materials and configuration indicated.
   2. Sinks fabricated from the same solid surfacing materials as the tops.

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 manufactured wood casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

A. Install level, plumb, and true; shim as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
   1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.

C. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, or framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
   1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c.
   2. Use toggle bolts at hollow masonry.
   3. Use expansion anchors at solid masonry.
   4. Use No. 10 wafer-head screws sized for 1-inch penetration at wood hanging strips.
   5. Use No. 10 wafer-head screws sized for 1-inch penetration into wood blocking.
   6. Use No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish at metal-framed partitions.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

E. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF TOPS

A. Field Jointing: Where possible make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
   1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

B. Secure tops to cabinets with Z- or L-type fasteners or equivalent, using two or more fasteners at each front, end, and back.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

D. Secure backsplashes and end splashes to walls with adhesive.

E. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 INSTALLATION OF SHELVING

A. Securely fasten shelf standards to masonry, partition framing, wood blocking, or reinforcements in partitions.
   1. Fasten shelf standards at ends and not more than 12 inches o.c.
   2. Use toggle bolts at hollow masonry.
   3. Use expansion anchors at solid masonry.
   4. Use self-tapping sheet metal screws in metal framing or metal backing at metal-framed partitions. Do not use wall anchors in gypsum board.
   5. Use wood screws sized for 1-inch penetration into wood blocking.
   6. Use toggle bolts at plaster on metal lath.

B. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Space standards not more than 36 inches o.c.

C. Install shelving level and straight, closely fitted to other work where indicated.

3.5 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123200

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Fire-suppression demolition.
7. Concrete bases.
8. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, 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.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. 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.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.3 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: **EPDM** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: **Stainless steel**. Include two for each sealing element.

D. Connecting Bolts and Nuts: **Stainless steel** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: **Polished chrome-plated.**

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. 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 Coordination Drawings.

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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
F. 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 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. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
    2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.3 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

    1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
    2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
    3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
    4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    5. Install anchor bolts to elevations required for proper attachment to supported equipment.
    6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
    7. Use **3000-psi**, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "**Cast-in-Place Concrete**."

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.5 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

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SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Wet-pipe sprinkler systems.

B. See Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.

1.2 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).

B. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Building Service Areas: Ordinary Hazard, Group 1.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas: Ordinary Hazard, Group 1.
d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
e. Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm/sq.ft. over 1500 sq. ft..
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq.ft. over 1500 sq. ft..
c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft..

4. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft..
b. Storage Areas: 130 sq. ft..
c. Mechanical Equipment Rooms: 130 sq. ft.
d. Electrical Equipment Rooms: 130 sq. ft..
e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

C. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads.

1.4 SUBMITTALS

A. Product Data: For each product indicated.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

C. Field test reports and certificates.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
4. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
5. NFPA 230, "Fire Protection of Storage."

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Victaulic Co. of America.
2) Engineer Approved equal.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
d. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe[hot-dip galvanized where indicated]. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory-square-cut-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Engineer Approved Equal.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig (1200-kPa) minimum working-pressure rating and ends according to the following:

1. NPS 2 (DN 50) and Smaller: Threaded.
2. NPS 2-1/2 (DN 65) and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Anamet Inc.
2. Flex-Hose Co., Inc.
3. Flexicraft Industries.
4. Flex-Pression, Ltd.
5. Flex-Weld, Inc.
6. Hyspan Precision Products, Inc.
7. Mercer Rubber Co.
8. Metraflex, Inc.
9. Proco Products, Inc.
10. Unaflex Inc.
11. <Insert manufacturer's name.>

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping.

B. Outlet Specialty Fittings:

1. Manufacturers:

a. Anvil International, Inc.
b. Central Sprinkler Corp.
c. Ductilic, Inc.
d. JDH Pacific, Inc.
e. National Fittings, Inc.
f. Shurjoint Piping Products, Inc.
g. Southwestern Pipe, Inc.
h. Star Pipe Products; Star Fittings Div.
i. Victaulic Co. of America.
j. Ward Manufacturing.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

a. Central Sprinkler Corp.
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:

a. AGF Manufacturing Co.
b. Central Sprinkler Corp.
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

a. CECA, LLC.
b. Merit.

2.6 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with operating wrench, extension rod, locking device, and cast-iron barrel.
3. Manufacturers:

a. Grinnell Fire Protection.
b. NIBCO.
c. Stockham.
d. <Insert manufacturer's name.>

C. Butterfly Valves: UL 1091.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Global Safety Products, Inc.
2) Milwaukee Valve Company.
3) Victaulic Co. of America.

2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with grooved ends.

a. Manufacturers:

1) Central Sprinkler Corp.
2) Global Safety Products, Inc.
3) McWane, Inc.; Kennedy Valve Div.
4) Mueller Company.
5) NIBCO.
6) Pratt, Henry Company.
7) Victaulic Co. of America.

D. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:
   a. Grinnell Fire Protection.
   b. Mueller Company.
   c. NIBCO.
   d. Potter-Roemer; Fire Protection Div.
   e. Stockham.
   f. Victaulic Co. of America.
   g. Watts Industries, Inc.; Water Products Div.

E. Gate Valves: UL 262, OS&Y type.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

   a. Manufacturers:

      1) Crane Co.; Crane Valve Group; Crane Valves.
      2) Hammond Valve.
      3) NIBCO.
      4) United Brass Works, Inc.

2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.

   a. Manufacturers:
      1) Crane Co.; Crane Valve Group; Crane Valves.
      2) Crane Co.; Crane Valve Group; Jenkins Valves.
      3) Milwaukee Valve Company.
      4) Mueller Company.
      5) NIBCO.
      6) United Brass Works, Inc.

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
2. NPS 2 (DN 50) and Smaller: Ball or butterfly valve with bronze body and threaded ends.

   a. Manufacturers:

      1) Milwaukee Valve Company.
      2) NIBCO.
      3) Victaulic Co. of America.

3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:
   1) Grinnell Fire Protection.
   2) Milwaukee Valve Company.
   3) NIBCO.
   4) Victaulic Co. of America.

2.7 UNLISTED GENERAL-DUTY VALVES

A. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

B. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

C. Globe Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.8 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig (1200-kPa) minimum pressure rating.

1. Manufacturers:
   a. Grinnell Fire Protection.
   b. Victaulic Co. of America.
   c. Viking Corp.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
   b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

B. Automatic Drain Valves: UL 1726, NPS 3/4 (DN 20), ball-check device with threaded ends.

1. Manufacturers:

   a. AFAC Inc.
   b. Grinnell Fire Protection.

2.9 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating.

B. Manufacturers:
   1. Grinnell Fire Protection.
   2. Victaulic Co. of America.
   3. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1626, for residential applications.
3. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Flush ceiling sprinklers, including escutcheon.
3. Pendent sprinklers.
4. Quick-response sprinklers.
5. Recessed sprinklers, including escutcheon.
6. Sidewall sprinklers.
7. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.10 HOSE CONNECTIONS

A. Manufacturers:

1. AFAC Inc.
2. Central Sprinkler Corp.
3. Elkhart Brass Mfg. Co., Inc.
4. Fire-End and Croker Corp.
5. Fire Protection Products, Inc.
6. GMR International Equipment Corporation.
7. Grinnell Fire Protection.
8. Guardian Fire Equipment Incorporated.
9. McWane, Inc.; Kennedy Valve Div.
10. Mueller Company.
11. Potter-Roemer; Fire-Protection Div.
12. United Brass Works, Inc.

B. Description: UL 668, brass or bronze, 300-psig (2070-kPa) minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated
2. Finish: Rough metal or chrome-plated.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:
   1. Fire Protection Products, Inc.
   2. Guardian Fire Equipment Incorporated.
   3. Potter-Roemer; Fire-Protection Div.
   4. United Brass Works, Inc.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig (1200-kPa) minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."

   1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
   2. Type: Exposed, projecting, with two inlets and round escutcheon plate.
   3. Finish: Polished chrome-plated.

2.12 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- (250-mm-) diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 (DN 20) inlet and NPS 1 (DN 25) drain connections.

   1. Manufacturers:
      a. Grinnell Fire Protection.
      b. Reliable Automatic Sprinkler Co., Inc.
      c. Viking Corp.

C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

   1. Manufacturers:
      a. Grinnell Fire Protection.
      b. ITT McDonnell & Miller
      c. Potter Electric Signal Company.
      d. System Sensor.
      e. Viking Corp.
      f. Watts Industries, Inc.; Water Products Div.

D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

   1. Manufacturers:

      a. McWane, Inc.; Kennedy Valve Div.
      b. Potter Electric Signal Company.

c. System Sensor.

2.13 PRESSURE GAGES

A. Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS, GENERAL

A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

C. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints.

D. Underground Service-Entrance Piping: Ductile-iron, grooved-end pipe and fittings; grooved-end-pipe couplings; and grooved joints.

3.2 STANDPIPE SYSTEM PIPING APPLICATIONS

A. Grooved-end, black, standard-weight steel pipe with square-cut- or roll grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

A. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

B. NPS 2 (DN 50) and Larger: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

C. NPS 2 (DN 50) and Larger: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.4 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

a. Shutoff Duty: Use butterfly or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.

a. Shutoff Duty: Use butterfly or gate valves.
b. Throttling Duty: Use globe valves.

3.5 JOINT CONSTRUCTION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Twist-Locked Joints: Insert plain-end piping into locking-lug fitting and rotate retainer lug one-quarter turn.

D. Pressure-Sealed Joints: Use UL-listed tool and procedure. Include use of specific equipment, pressure-sealing tool, and accessories.

E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

3.6 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 22 Section "Facility Water Distribution Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 22 Section "Facility Water Distribution Piping" for backflow preventers.

3.7 WATER-SUPPLY CONNECTION

A. Connect fire-suppression piping to building's interior water distribution piping. Refer to Division 22 Section "Domestic Water Piping" for interior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

3.8 PIPING INSTALLATION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install drain valves on standpipes.

J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

K. Install alarm devices in piping systems.

L. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
2. Install sprinkler system piping according to NFPA 13.

M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

O. Fill wet-standpipe system piping with water.

P. Fill wet-pipe sprinkler system piping with water.

3.9 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

D. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.10 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers, as indicated.
3. Wall Mounting: Sidewall sprinklers.
4. Sprinkler Finishes:

    a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
    b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
    d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.11 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.12 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes, unless otherwise indicated.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install hose-connection valves with flow-restricting device, unless otherwise indicated.

D. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Refer to Division 10 Section "Fire Extinguisher Cabinets" for cabinets.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire department connections in vertical wall.

B. Install freestanding-type, fire department connections in level surface.

1. Install protective pipe bollards on two sides of each fire department connection. Refer to Division 05 Section "Metal Fabrications" for pipe bollards.

C. Install ball drip valve at each check valve for fire department connection.

3.14 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 26.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.15 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.16 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Coordinate with fire alarm tests. Operate as required.
5. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

END OF SECTION 211000

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Provide items, articles, materials, operation and methods required by drawings and specifications including labor, equipment, supplies and incidentals necessary for completion of work in Division 22 – Plumbing.

B. Design Engineer, hereinafter abbreviated D/E shall mean the Engineering firm, Olsson Associates, 1251 NW Briarcliff, Kansas City, MO, Telephone (816) 361-1177. Contact person: Nick Lynch.

1.2 RELATED DOCUMENTS

A. The General Provisions described herein, together with the conditions of contract, and the General Requirements of Division 1, apply to the work in Division 22 – Plumbing.

B. This Section is hereby made a part of all other Sections of Division 22 – Plumbing, as if repeated in each.

1.3 QUALITY ASSURANCE

A. All permits and licenses that are required by governing authorities for the performance of shall be procured and paid for by the Contractor.

B. All work shall be performed in compliance with all applicable and governing safety regulations including the regulations of the Occupational and Safety Health Act. All safety lights, signs and guards required for performance of work shall be provided by the Contractor.

C. All work shall conform to the requirements of all applicable codes, ordinances and regulations including the rules and regulations of the National Electrical Code, the National Fire Protection Association, the International Plumbing Code, OSHA and all State and Local laws, codes and ordinances.

D. Laws, codes, ordinances and regulations shall take precedent excepting only where the work called for by the drawings and specifications exceeds by quality and quantity.

E. Fixtures, appliances, equipment and materials which are subject to Underwriter's Laboratory tests shall bear such approval.

F. Mechanical and electrical designs are based on the requirements for the specified manufacturers listed on the equipment schedules. Conduit, disconnects, motor starters, breakers, fuses and wire sizes are selected on basis of scheduled equipment. Increased current requirements necessitating larger wire, breakers, switches, etc., to accommodate any alternate or substitute manufacturer's equipment, other than as shown on drawings shall be provided without any increase in contract price by contractor furnishing the equipment.

G. Manufacturers, where specifically called for, must provide factory tests, unit installation observations, unit start-up and tests, etc., as specified, and submit signed reports to the Engineer upon completion of these services. Subletting of these services will not be permitted. Shop drawing submittals shall be accompanied with a letter of certification by the manufacturer that the specified services shall be provided. Failure to do so shall be cause to reject the shop drawing submittals.

H. The contract drawings are in part schematic and intended to convey the scope of work and indicate the general layout, design and arrangement. The Contractor shall follow these drawings in the layout of his work and shall consult general construction drawings, electrical drawings and all other drawings for this project, and shall verify all existing site conditions to determine all conditions affecting the work shown or specified. The contract drawings are not to be scaled and the Contractor shall verify spaces in which the work is to be installed.

I. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Engineer shall be notified before proceeding with installation.

J. Work in cooperation with one another to fit piping and work from other Divisions into the structure as job conditions may demand. All final decision as to right of way and run of pipe, ducts, etc. to be made by Engineer or his representative.

K. All work shall be performed by trained mechanics of a particular trade involved and done in neat and workmanlike manner as approved by "Engineer".

1) Work shall be performed in cooperation with other trades and scheduled to allow timely and efficient completion of project.

2) Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for work, and also furnish information and shop drawings necessary to permit other trades affected to install their work properly without delay.

3) Where there is evidence that work of one trade will interfere with work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments.

L. Work installed before coordinating with other trades causing interference with work of such other trades shall be changed to correct such condition without increase in contract price and as directed by Engineer.

M. Where specific details and dimensions are not shown on the drawings, the Contractor shall take measurements and make layouts for the proper installation of the work and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications, it shall be assumed, by the signing of the Contract, that the higher cost (if any difference in costs) is included in the contract price, and the Contractor shall perform the work in accordance with the drawings or with the specifications, as determined and approved by the Engineer.

N. The Contractor shall be responsible for a scheduled sequence in performing the work so that it will not interfere with the Owner's operation in the existing building. Before any work is started, the Contractor shall consult with the Engineer and Owner and arrange a satisfactory schedule.

1) Make temporary alterations as required to execute work so that all operations and services in the existing building are maintained with the minimum possible interruption.

2) Temporary shut-downs shall be segregated and shall be of the shortest possible duration. All facilities shall be kept in continuous operation unless specific permission to the contrary is granted by Owner.

O. Definitions:

1) "Piping" includes, in addition to pipe, all fittings, valves, sleeves, hangers, and other supports and accessories related to such piping.

2) "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, or in crawl spaces.

3) "Exposed" means not installed underground or "concealed" as defined above.

4) The words "furnish and install", "provide", "furnish", "install", or equivalent words are used or are understood, to mean the Contractor shall furnish and completely install the system, service, equipment, or material named, together with other associated devices, equipment, material, wiring, piping, etc. as required for a complete operating installation, and conforming to the manufacturer's standards and recommendations.

5) It is the intent of these specifications and drawings to call for finished work, tested and ready for operation.

6) All apparatus, appliances, materials or work not shown on drawings, but mentioned in specifications, or vice versa, and/or all incidental accessories necessary to make work complete and ready for operation, even though not specified or shown on drawings, shall be furnished and installed without increase in contract price.

7) Should there be discrepancies or questions of intent, refer matter to Engineer in writing for decision before ordering any equipment or materials or before starting any related work.

1.4 SHOP DRAWINGS AND SAMPLES

A. Shop drawings, project data and samples furnished by the Contractor shall illustrate materials, equipment or workmanship, and establish standards by which the work will be judged.

B. Shop Drawings and Samples shall be submitted to the Engineer by a letter of transmittal. The party making the submission shall be named on Shop Drawing/Sample and also in the letter of transmittal.

C. When Shop Drawing submissions are in the form of loose pages (8½" x 11") they shall be submitted in sets assembled in portfolio binders showing on the covers or first page inside, a complete list of contents. A minimum of 7 sets of each submission are required, however, additional copies may be requested.

D. When Shop Drawing submissions are in the form of portable document format (PDF), they shall be transmitted via email to the contact information provided during the pre-construction conference. Each submittal transmitted in PDF format shall include only one specification section. Multiple specification section submittals combined into one singular PDF file will not be accepted. The cover page of the submittal shall include all necessary information for proper identification of project, submittal, and date, and shall include a blank area, minimum 4-1/4" by 5-1/2" in size, for placement of the engineer's review stamp. The email transmittal and PDF file naming shall be compliant with the following guidelines:

1) Email submittals to be addressed to: TBD, as instructed during pre-construction conference.

2) Email subject line shall include the following information, in order of listed below and separated by dashes:

(a) "SUBMITTAL"

(b) Project Number (as listed in titleblock and specifications).

(c) Specification Section Number

(d) Specification Title

(e) "FOR REVIEW"

(f) Example: "SUBMITTAL-14071.1-220523-Plumbing Valves-FOR REVIEW"

3) The PDF file for the actual submittal shall be compliant with the following guidelines:

(a) Project Number (as listed in titleblock and specifications).

(b) Specification Section Number

(c) Sequence Number (separated from section number by a 'dot'). In the case of a resubmittal, the sequence number shall remain the same as the previously submitted file, and shall be

(d) Specification Title

(e) "FOR REVIEW"

(f) Example: "14071.1-220523.01-Plumbing Valves-FOR REVIEW.pdf".

4) Failure to follow email transmittal or document naming guidelines will result in an automatic rejection of submittal.

E. The Contractor shall review, stamp with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other contractor, all Shop Drawings and Samples required by the Contract Documents or subsequently by the Engineer as modifications. Shop Drawings and Samples shall be properly identified as specified or as the Architect/Engineer may require. At the time of submission, The Contractor shall inform the Architect/Engineer in writing of any deviation in the Shop Drawings or Samples from the requirements of the Contract Documents.

F. Except in the case of brochures, catalogue cuts and the like, shop drawings shall be in the form of a reproducible print(s) (sepia). In every case, the submittal shall consist of one sepia of each shop drawing and two (2) black line prints of the same. Each print shall be made from the original shop drawing tracing. The transparency shall be capable of producing clean, clear black and white prints.

G. Contractor shall stamp each sepia and black line print (shop drawing) the same. He shall also stamp each brochure, sample and the like. Special Note: Every page with project information

shall be stamped. In every instance, the document shall be reviewed by the Contractor and shall also be signed by the Contractor indicating that the document has been reviewed, and that it is approved by the Contractor. The submittals will not be reviewed without the Contractor's approval stamp and signature.

H. The Contractor's approval stamp and signature shall signify that the Contractor has checked the submittals. Any submittals which have not been checked shall be returned to the Contractor for checking, approval stamp, signature, and resubmittal for compliance with the contract documents. After review of the submittals they will be returned to the Contractor with one of the following remarks checked:

1)	No Exceptions Taken	SUBJECT TO CONTRACT DOCUMENTS.
2)	Note Corrections	SUBJECT TO CONTRACT DOCUMENTS RESUBMISSION NOT REQUIRED.
3)	Revise and Resubmit	REVISE, RESUBMISSION REQUIRED.
4)	Rejected	NOT APPROVED.

I. Upon receipt of exhibits submitted and marked for resubmittal the Contractor shall cause the marked corrections and corrections that may be contained in the Architect/Engineer transmittal letter to be made on each submittal. All such corrections shall be circled, numbered, and dated to permit prompt reviewing upon resubmittal to the Architect/Engineer. Upon receipt of each submittal now marked:

J. The Contractor shall cause submittals to be distributed to the respective contractors and suppliers as is necessary for proper performance of work.

K. At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the exhibits submitted from the requirements of the Contract.

L. The Engineer will review exhibits submitted with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Project and with the information given in the Contract. The Engineer's review of a separate item shall not indicate review of an assembly in which the item functions. The Engineer's review is not intended to indicate approval of dimensions or quantities.

M. Contractor shall make any corrections required by the Engineer and shall resubmit the required number of submittals until further resubmittals are no longer required.

N. Engineer's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract unless the Contractor has the Engineer's approval in writing of such deviation at the time of submission and the Owner's Representative has given written notice to the specific deviation; nor shall the Engineer's review relieve the Contractor from responsibility for errors or omissions in the submitted exhibits.

O. No portion of the work requiring a submittal shall be commenced until the Engineer has reviewed the submission. All such portions of the work shall be in accordance with reviewed submittals.

1.5 OPERATION AND MAINTENANCE MANUALS

A. In addition to the requirements specified in Division 1, the Contractor at the project's completion shall submit a complete system operating and maintenance manual. O&M manual shall be organized into systems and shall contain the manufacturer's complete detailed operating and maintenance instructions with equipment data for each piece of installed equipment furnished under this project. Manual at a minimum shall include the following:

B. Manual shall be composed of typed instructions sheets with large drawing sheets (not reduced) folded in with reinforced margin, shall have a post binder system so that sheets can be easily substituted, and shall have a hard cover.

C. Include in O&M manuals Manufacturers written maintenance instruction for each different piece of equipment provided and installed on this project.

D. Include spare parts list for each major piece of equipment furnished for the project including but not limited to medical gas zone panels, control panels, and accessories.

E. Provide a comprehensive list of maintenance procedures for preventative maintenance and troubleshooting; disassembly, repair and reassemble; aligning and adjusting instructions.

PART 2. EQUIPMENT

2.1 GENERAL

A. All materials and equipment shall be new and shall bear manufacturer's name, model number and other identification marking.

B. All materials and equipment shall be standard product of manufacturer regularly engaged in production of required type of material or equipment for at least 5 years (unless specifically exempted by Engineer) and shall be manufacturer's latest design having published properties.

2.2 EQUIPMENT FURNISHED BY OWNER OR OTHER TRADES

A. Owner furnished equipment includes the following:

1) As specifically noted on drawings.

B. Equipment furnished by other trades includes the following:

1) As specifically noted on drawings.

C. General

1) The following paragraphs describe the Contractor’s responsibilities for receiving and installing this equipment after shipment from the Manufacturer. Contractor shall complete all installation in accordance with this and other relevant Sections within this Division.

D. Receiving and Inspection

1) All equipment is shipped F.O.B to the jobsite. All delivery and transportation charges will be prepaid, so that Contractor will not incur additional shipping charges. Upon receipt of equipment, Contractor shall inform Owner/Owner’s Representative and provide a copy of the bill of lading. Maintain delivery records for inventory control and for use in processing payment request vouchers. Crosscheck delivery records with project schedule so as to eliminate work stoppages due to material shortages.

2) The Contractor shall be responsible for coordinating with the manufacturer for installation of the equipment furnished above as shown on drawings. The Contractor shall be responsible for warranty work required and shall coordinate with the manufacturer of the equipment to accomplish warranty work including any labor and additional cost for such warranty work. The Equipment Manufacturer shall provide the Contractor with installation manuals and instructions to the Contractor. The Contractor shall receive and install this equipment for a complete furnished and installed installation including all accessories as specified within these specifications and as shown on drawings.

3) The Contractor shall check equipment and trim delivered to job site by Equipment Supplier against approved shop drawings or other required documentation. The Contractor shall report all discrepancies, shortages, or lack of data to the Owner and Equipment Supplier for adjustments within 1 week after equipment is received. If such report is not made within one week, it shall be assumed no discrepancies, shortages, or lack of data has been found.

4) The Contractor is responsible for off-loading of shipped equipment. Contractor shall handle products, materials, and equipment in accordance with manufacturer's recommendations and recognized industry standards. Contractor shall utilize lifting lugs, and designated lift points when hoisting equipment. In all cases, Contractor shall carefully handle, transport, and position items to prevent damage during construction.

5) An access restricted area shall be provided for the storage of all supplemental equipment, accessories and materials. This restricted area shall be divided into two distinct areas designated as “quarantined” and “released”. The storage area designated as “quarantined” shall be used to store equipment, materials and accessories prior to inspection and acceptance. Under no circumstances shall an item be removed from quarantined storage until it designated as “released”. After the equipment, material or accessory has been inspected and approved for installation, based on the review of specifications and drawings, the item

shall be relocated to the "released" area, where the contractor shall install the unit according to the project schedule.

6) Contractor shall store equipment and components in a manner to prevent damage and degradation. Store items on skids or pallets, elevated above the floor or grade. Store items subject to moisture damage in a dry location. Retain protective shipping covers, crates, and cartons during storage. Protect items from contamination by jobsite dirt and debris and other foreign matter. Provide a secure, fenced and lighted area for outside jobsite storage where required.

7) The Contractor is responsible for inspection and verification of all supplemental equipment. Contractor shall verify all equipment received is properly marked with product names, model numbers, types, grades, compliance labels, and other information needed for identification.

8) Shipment shall be verified in accordance with all data and information on specifications and submittals, including quantities, accessories, sizes, dimensions, utility requirements and general compliance. Contractor is responsible for final dimensions, verification of installation requirements and utility connections, which shall be confirmed at the job site. Contractor shall notify the Owner/Owner's Representative of any deviations from the requirements of the Purchase Order, Drawings, or Specifications.

9) Contractor shall receive and inspect all tanks and agitators. Shipment shall be verified with approved shop drawings, and all attachments shall be accounted for. If any accessory is not received contractor shall notify manufacturer. Contractor is responsible for tracking receipt and storage of all tanks and appurtenances.

10) If, during the course of inspection or installation, any of the goods received are found to be defective in material or workmanship, or otherwise not in conformity with the Purchase Order requirements, the Contractor shall notify the Owner/Owner's Representative, who shall retain the right to reject or revoke acceptance and return the goods. Such goods are not to be repaired, altered or replaced without written authorization from the Owner/Owner's Representative.

E. Installation

1) Contractor shall verify and integrate the installation of the supplemental equipment with the various elements of the building systems based on their review of latest information provided in the approved submittal data and coordination drawings. Install supplemental equipment to conform with all utility systems, electrical components and controls based on the Construction Drawings and the associated specifications provided. Where coordination requirements conflict with individual system requirements refer conflict to the Owner/Owner's Representative.

2) If greater capacity or more materials or labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then it shall be the responsibility of the parties involved in providing the substitute and/or equivalent items of equipment to provide all compensation for additional charges made for the proper rough-in, circuitry and connections for the equipment furnished.

3) Contractor shall install supplemental equipment where indicated in the Construction Drawing set, in accordance with equipment manufacturer's written instructions and with recognized industry practices, to ensure that the equipment complies with requirements and serves intended purposes. Contractor shall install supplemental equipment in accordance with manufacturer's installation instructions, level and plumb, firmly anchored, and maintain manufacturer's recommended clearances for servicing and maintenance.

4) Contractor shall connect and install all appurtenances, accessories and devices furnished by manufacturer but not specified to be factory-mounted or packaged separately for protection during shipping. For example, remote automated valves, utility booster pumps or tank agitators shall be installed per manufacturer's recommendations as indicated on the drawings.

5) After placement or installation, cover items with tarps or sheeting where required to protect from damage during construction.

6) Contractor shall install tanks level and plumb. Installation of weigh cells, if required, under tanks shall be completed where indicated on drawings. Installation of tanks through floors, if required, shall be completed as indicated on drawings. Contractor shall install all appurtenances not installed at manufacturer's facility.

7) After installation is approved, all agitators shall be bumped to check rotation.

F. Start-up and Commissioning

1) Prior to final acceptance, operate systems and equipment for a minimum of 48 continuous hours after normal operating conditions are achieved, as approved by the Owner/Owner's Representative. The Contractor shall obtain suitable training or assistance for the operation of unfamiliar systems or equipment prior to start-up or operation. The Contractor shall clean systems or equipment and install new filters, screens, etc. based on manufacturer's recommendations prior to final acceptance by the Owner/Owner's Representative.

2) Adjust all systems and equipment to provide operation as described on the drawings and specified herein. Properly align and adjust drive components, bearings, etc. for all equipment to eliminate excess noise and vibration as acceptable to the Owner/Owner's Representative.

3) Commissioning is the process of verifying that the installation of equipment has been completed in a manner that allows safe and acceptable start-up, and that the equipment is functioning as intended. Commissioning encompasses the testing and documentation required to be completed before the Contractor is finished. It will serve as a tool to alleviate post-occupancy difficulty or failure of supplemental equipment, and shall record data in an effort to advance the systems from a state of substantial completion to dynamic operation and assist in the validation documentation. The Owner/Owner's Representative and any issuance of completion certification shall complete the commissioning documentation prior to equipment installation acceptance. The documentation shall consist of Owner/Owner's Representative provided checklists to be completed by the appropriate Contractor, and verified by the Owner or Owner's Representative. In many instances, the equipment Manufacturer will assist with commissioning services after installation. However, it is the responsibility of the Contractor to complete all documentation.

4) Commissioning activities shall be guided by protocols and datasheets furnished by Owner/Owner's Representative, and will consist of installation verification, operational verification and documentation. An example of the commissioning documentation has been provided with the construction specifications. The Contractors responsibilities for installation verification will consist of an installation audit that will include information pertaining to material verification, manufacturer and model number, utility connections and flow data, loop checks, cleaning and passivation. The Contractor's responsibilities for operational verification will consist of an operational audit that will consist of information pertaining to calibration, input/output testing, operating and control demonstration, alarm verification, and start-up.

2.3 FIRESTOPPING

A. Firestopping is defined herein as the process of furnishing and installing a material, or combination of materials, in various constructions to maintain an effective barrier against the spread of flame, smoke, and gasses and to retain the integrity of time-rated construction. It shall be used in specific locations as specified hereinafter.

1) Piping penetrations through floor slab and through time-rated partitions of fire walls;

2) Opening between floor slabs and curtain walls, including inside hollow curtain walls at the floor slab;

3) Penetrations of vertical service shafts;

4) Openings and penetrations in enclosures with time-rated fire doors;

5) Other locations where specifically shown on drawings or where specified in other sections of these specifications;

6) Openings in non-time-rated construction shall be closed with a compacted fill of ¾ lb. density fiberglass and then sealed gas tight.

B. Material of firestopping shall be asbestos free and capable of maintaining an effective barrier against flame, smoke and gases in compliance with the requirements of ASTM E 814, UL NO. 1479. Fire-stopping material shall be manufactured by 3M barrier products. Products shall be capable of providing a cold smoke and water seal. When exposed to temperatures exceeding 250ºF these products shall rapidly expand up to ten times the original volume.

C. Installation of fire stopping shall be in accordance with the manufacturer's recommendations and requirements. Surface to be in contact with firestopping shall be cleaned of dirt, grease, oil,

loose materials, rust, or other substance that may affect proper fitting or the required fire resistance.

D. Firestopping materials shall provide an effective barrier regardless of the geometric configurations of the void spaces. Firestopping materials for filling voids in floors having openings of four (4) inches or more shall be installed to support the same load as the floor is designed to support, unless the area is protected by a permanent barrier preventing loading or traffic on the fire-stopped area.

E. At a minimum fire stop systems shall be designed to achieve a 2-hour F rating with an emphasis on also achieving a 2-hour T rating. In addition to fire and thermal protection, fire stop systems shall be designed to provide a barrier to the transmission of smoke and toxic fumes.

F. A firestop system as defined by these specifications shall consist of fire barrier products, in certain configuration and quantity, to meet the intent of the specifications above. Fire protection products include:

1) 3M fire barrier CS-195 composite sheet
2) 3M fire barrier moldable putty
3) 3M fire barrier CP 25WB caulk
4) 3M fire barrier FS-195 wrap/strip

G. Firestop systems for floor and chase penetrations shall be installed on both sides of the penetration (top and bottom) (in and out). Firestop systems shall be symmetrically installed on both sides and shall meet or exceed all requirements for AT&T standard practices.

2.4 ELECTRICAL EQUIPMENT

A. General: Unless specifically specified or shown otherwise, the Contractor shall furnish required motors, variable speed drives with controls, and disconnect switches for equipment furnished under this Division. Motors, drives, and associated controls, and disconnecting equipment shall be provided where indicated and as required for operation of the equipment being furnished. Motors shall be designed for full voltage starting unless otherwise specified or noted on drawings and shall be suitable for continuous duty at 40 C. ambient. All motors shall be selected, designed and fabricated in conformance with the requirements of NEMA-MG-1 standard.

B. All motors shall be NEMA Design B induction motors with voltage and phase scheduled on drawings. Motors shall be equipped with Class F insulation, rated with a service factor of 1.15 and nominal full-load efficiency within 1.5% of the maximum values provided by the National Electrical Manufacturers Association Standard 12.6C in publication MG 1. The motor efficiency testing standards for all motors is IEEE Standard 112-1984, "Standard Test Procedure for Polyphase Induction Motors and Generators". All motors shall have a 2% - 5% power factor improvement over typical standard efficient motors. Motors shall comply with the frame size assignments of NEMA MG 13-1984. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

C. Rating: Motor rating, service factor and nameplate data shall conform to the requirements of NEMA-MG-1 standards. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

D. Nameplate data shall conform to NEMA MG 1 requirements. For motors of one horsepower and greater, the following additional nameplate data shall be included:

1) Manufacturer's identification number
2) Frame size number
3) Insulated system class designation
4) Service factor
5) Locked-rotor KVA code letter

6) Starting limitations (if any)

7) Hazard classification (if approved)

(a) Design and construction of each motor shall be coordinated with the driven equipment requirements.

E. Service factor - All motors of one horsepower and greater shall be furnished with a service factor of 1.15 in accordance with NEMA-MG-1.

F. Enclosures - All motors shall be self-cooled. Motors for indoor service shall have drip-proof enclosures. Motors for outdoor service shall be totally enclosed and shall have all exposed metal surfaces protected, where practical, with a corrosion resistant polyester paint or coating. Exposed unpainted and uncoated metal surfaces shall be of a corrosion resistant material. All self-ventilated open type motors and the fan hoods of totally enclosed fan cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine. Totally enclosed motors shall be furnished with cast iron frames, bearing brackets and terminal housings. Fan cooled motors shall have fans fabricated of corrosion resistant metal and cast iron fan covers.

G. Bearings for fractional horsepower motors shall be designed to operate in any position or angle. One-piece sleeve bearings with wick lubrication shall be furnished where available. Ball bearings shall be furnished where sleeve bearings are not available and where axial thrust loads exceed 20 pounds.

H. Bearings for motors of one horsepower and greater shall be oil lubricated sleeve bearings. If motor frame size is such that sleeve bearings are not available, bearings shall be grease lubricated rolling element type, self-lubricated and re-greaseable.

2.5 DISCONNECT SWITCHES

A. Material - Disconnect switches shall be NEMA type HD (Heavy Duty) quick-make, quick-break disconnect switches not furnished by others with equipment and where indicated on drawings or where required by Code. Switches shall be fusible or non-fusible as called for or as required. Switches shall have NEMA I enclosure unless otherwise specified or called for otherwise on drawings. Switches shall have door interlock and shall be padlockable in "open" and "closed" position. Where indicated for use in motor circuits utilizing VSDs switch shall be furnished with interlock contacts for interface with VSD, preventing operation of VSD when load is disconnected.

B. Reference E-series drawings and Division 26 for disconnect switches provided by electrical contractor. If not shown and required it is assumed the equipment manufacturer is providing it. If not, the contractor shall be responsible for all providing including all labor for installation.

2.6 MOTOR STARTERS

A. Starters shall be in accordance with NEMA ICS, UL 508 and the following paragraphs:

B. All starters installed indoors shall be in a NEMA 1 enclosure and all starters installed outdoors shall be in a NEMA 4 enclosure. Enclosures shall be designed for surface mounting unless otherwise indicated.

C. Each starter shall have a nameplate on the cover. Nameplates shall be made of laminated black and white plastic with the white on the outside. Lettering shall be bold, not less than 1/4 inch square, engraved through the white outside layer so that the letters appear black. Nameplate wording will be furnished as called for on drawings or as approved by the Owners Representative.

D. Magnetic starters shall include 480 volt, 3-phase, 60 hertz contractors with three manual reset thermal overload relays, 120 volt operating coils, and 480 to 120 volt dry type control transformers complete with one secondary lead fused and the other secondary lead grounded. Large size starters which require line voltage to energize the operating coils shall be equipped with auxiliary contractors for use in the operating coil circuit. These contractors shall be operated from the 120 volt circuit of the control transformers. Reduced voltage starters shall be closed transition auto transformer type equipped with taps for 50, 65 and 80 percent of full voltage. Two speed starters and reversing starters, shall be mechanically and electrically interlocked so that only one set of contacts can be closed at any one time. Contractors shall have a current rating in accordance with NEMA standard ICS.

E. Two each normally open and normally closed interlock contacts shall be furnished with each starter as indicated. Additional interlocks shall be as called for on drawings.

F. Three thermal overload relays of the bimetallic strip or euthenic alloy type shall be furnished with each motor starter. Thermal overload relay heaters shall be sized to protect their associated motors of the circuits from damage due to overload. Provisions shall be made for manually resetting the thermal relay without opening the starter cover.

G. Control Transformers shall have 60 hertz ratings permitting operation at a primary voltage ranging from 208 to 240 volts. Assuming 208 volts on the primary terminals, each control transformer shall maintain a minimum potential of 105 volts at its secondary terminals during starter coil inrush, while simultaneously serving an additional load of 100 volt amperes at 50 percent power factor. Control transformers shall be mounted in the enclosure with the magnetic starter.

H. Each magnetic starter shall be equipped for control from local remote push-button or control switch, or other pilot devices as called for on drawings. All necessary internal wiring for this feature shall be supplied and connected to terminal blocks located to provide easy connection to the external control wiring.

I. A push to test running pilot light shall be provided and mounted in the cover of each magnetic starter to indicate when the motor is in operation. The light shall be of the transformer type with a 6 volt bulb and a red color cap.

J. "Hand-Off-Auto" Selector Switch Units shall be provided and mounted in the cover of the starter as indicated in these specifications and as indicated on drawings. Units shall be heavy-duty, oil-tight and shall be complete with contact blocks and legend plates. Momentary contact "start-stop" push-buttons shall be provided with an auxiliary contact for use in the holding circuit.

K. Schematic Diagrams shall be as indicated on drawings or as approved by the Contracting Officer.

L. Each combination starter where indicated on drawings shall include a magnetic starter, as specified hereinbefore, and a disconnect switch or a fusible disconnect switch complete with fuses.

1) Each fusible disconnect switch unit shall include one 3 pole, 600 volt, quick-make, quick-break, manually operated switch connected in series with one replaceable dual element fuse per switch pole. The switch and fuse elements shall be sized according to the following:

Starter Size	Fuse Clip Size
00	30 ampere
0	30 ampere
1	60 ampere
2	60 ampere
3	100 ampere
4	200 ampere
5	400 ampere

M. Fuses shall be UL 198D Class K5, 600 volt, and dual element type. Fuses shall have a thermal element that restricts the temperature rise to 280° F. and an element of low peak type that limits the let through fault current. Fuses shall be rated at 200,000 amperes RMS symmetrical interrupting capacity and shall have a minimum time delay of 10 seconds at 500% of rating as specified hereinbefore.

N. A manual operating handle shall be mounted in the cover of each starter to operate the disconnect switch. The handle shall have provisions to lock in the open position with one or more padlocks. The cover and switch shall be interlocked so that the cover cannot be opened normally when the switch is in the closed position. Provisions shall be made for overriding this interlock.

O. Motor starters shall be wall or column mounted not more than six feet above the floor or mounted on the equipment if readily accessible from the floor or roof. Each starter shall be labeled on the cover as specified hereinbefore. The labeling shall be done with black letters on a white background. Letters are to be 1/4 inch high.

P. Nameplates - All major equipment items shall have a permanent stainless steel nameplate. Nameplates shall include the applicable items in the following list:

1) Manufacturer's size and type
2) Serial number
3) Design capacity
4) Design pressure
5) Design speed
6) Design temperature
7) Design static pressure "w.c."
8) Motor horsepower and RPM

Q. A permanently attached rotation arrow shall be provided on all items of rotating equipment.

PART 3. EXECUTION

3.1 CUTTING AND PATCHING

A. The responsibility for any cutting of construction, which is required for the installation work, shall be by the Contractor. The Contractor shall coordinate with the Owner before any cutting and obtain approval from the Engineer and the Owner prior to any cutting.

B. Where openings for work within this Division are provided under other sections of the specifications, this Contractor shall be responsible for locating and providing the proper dimensions for all such openings.

C. Cutting shall be done with extreme care and in such a manner that the strength of the structure will not be endangered. Wherever possible, openings in concrete or masonry construction shall be by concrete saw or rotary core drill. Openings in any construction shall be cut the minimum size required for the installation of the work.

1) Adequate protection shall be provided to prevent damage to adjacent areas and to prevent dust from spreading to adjacent areas.

2) The use of jackhammers will not be permitted.

D. Where openings or holes are cut in existing construction and the cutting breaks existing electrical circuitry or control circuitry, or communications, conduit and wiring, then it shall be the responsibility of the Contractor to have the circuitry, conduit and rewiring re-routed and to complete the circuitry as required and as approved by the Owner. Temporary completion shall be provided where necessary before the permanent re-routing and completion work is finished. All costs for this work shall be the responsibility of the Contractor and no additions will be allowed to the Contract price.

E. Before any cutting, patching, or finishing work is started, dust and moisture protection shall first be installed as required to protect adjacent construction and equipment and to prevent dust spreading from the immediate area where work is being performed.

F. After any work is installed through any opening in walls, partitions, ceilings, or floors, the opening around the work shall be patched to match the existing construction, and the openings around pipe sleeves, and between pipes and sleeves, shall be sealed watertight through floors and shall be sealed fireproof and smoke tight through floors, walls, partitions and ceilings.

G. Where existing work is removed from openings in existing construction and the opening is not to be reused for new work, the opening shall be filled and patched to match existing adjacent construction and to be watertight for floors and to be fireproof and smoke tight for floors and all other construction.

H. No structural member shall be cut without the approval of the Consultant, and all such cutting shall be done in a manner directed by him.

3.2 EXCAVATION AND BACKFILL

A. Work shall be performed as hereinafter specified and in accordance with the requirements of Division 31 and / or Division 33. Soil stabilization shall also be in accordance with Division 31 and / or Division 33.

B. Lines shall be used to layout the trenches for all underground work and there shall be no variation from the drawings except upon written order from the Engineer. Trenches close to walls, foundations, and columns shall not be excavated without prior consultation with the Architect or Owner or his Representatives.

C. All excavations shall be properly protected by the necessary bracing and timbers to prevent any collapses or damage to adjacent improvements. Where required to prevent collapses, the sides of the trenches shall be securely held by bracing or sheathing, which bracing or sheathing shall not be removed until the level of the backfill has reached the point where such removal can be safely carried out. Where adjacent improvements might be damaged by the removal of such bracing, the braces shall be left in place to prevent such damage. The thickness of the sheathing and the dimensions of the cross braces, shoes and miscellaneous supports to be used by the Contractor shall be as required and of type to properly protect the sides of the trench and to prevent injurious collapses or erosions.

D. The Contractor shall do all pumping and bailing necessary to keep all excavations free of water and shall provide for the uninterrupted flow of the surface water adjacent to the line of work during the progress of the work. The Contractor shall inspect the ground where excavation is required to ascertain the structure of the soil.

E. The Contractor shall cut and replace all existing walks, roads, street pavement, curbs, steps, retaining walls, and miscellaneous work removed or damaged by him in connection with the piping installation, whether or not the improvement is shown on the drawings. Such repairs shall be done to the satisfaction of the Architect, and where the work is performed on public property outside of the property lines, the Contractor shall obtain permits and permission from the proper authorities, shall perform all work to comply with requirements of the enforcing authorities and shall pay all costs relating to this work as a part of the contract bid price.

F. In cases where existing water, sewer, gas, electric or other pipes or conduits are encountered, they shall not be displaced or molested unless necessary, in which case, they shall promptly be replaced in good condition. All water, sewer, gas, conduits, or electric lines damaged or molested in the construction shall be replaced or repaired at the Contractor's expense. Wherever necessary to determine the locations of existing underground utilities, pipes, conduits, cables or other structures, examine all available records and make explorations and excavations as necessary to determine the locations.

G. The Contractor shall provide all temporary bridges, barricades, lanterns and such other signs and signals as shall be necessary to warn the public of the dangers caused by excavations and other obstructions.

H. The backfilling of trenches shall be carried out as rapidly as the testing and acceptance of the finished sections of the piping installation will permit. The trench shall be backfilled in layers not to exceed 6" with good selected dry earth thoroughly tamped with pneumatic tamper. Note: Broken stones, cinders, frozen earth and rubbish are not acceptable for backfilling. Before backfill operations commence on any new or replacement underground utility construction work, the Contractor shall give 48 hour notification to the Architect. Such notice shall be required so that the work can be inspected.

I. After backfilling, all surplus excavated material shall be removed from the grounds, to an authorized disposal site.

J. The work shall be executed so that existing culverts, drains, catch basins, retaining walls, fences or any other permanent structure along and adjacent to the new work are properly protected. The Contractor at his own expense shall repair any damage occurring to these structures.

K. The Contractor shall make a field inspection of the location along which the underground work is to be constructed and note all obstructions and improvements at the surface and overhead, which may affect this method of operation in the construction of these lines. Such overhead wires and underground pipes or conduits, which may be existing or which may be encountered, shall be protected by the Contractor during this construction.

3.3 ELECTRICAL COORDINATION

A. All electrical products and installation used on this project shall conform unless otherwise specifically noted, to applicable standards of the National Electrical Manufacturers Association,

NFPA 70, Division 26 of these specifications, and shall also be listed by Underwriter's Laboratories, Inc. and/or other agencies, as required.

B. Electrical power sources and motor connections for all equipment shall be provided as specified within Division 26 of these specifications. All control wiring, safety interlock wiring, and temperature control system wiring required shall be furnished and installed as specified within these specifications. The control wiring shall include the furnishing and installation of all conduit, boxes, fittings, devices, accessories, wire, and connections required for complete and properly functioning systems. All wiring shall be installed in conduit, and all splices and connections shall be made in approved type enclosures or boxes.

1) If motors or controls are not shown on the Electrical Drawings, it has been assumed that these motors and controls have been wired as part of a piece of package equipment, or that control wiring will be run by the Contractor.

C. Reports: The Contractor shall submit to the Engineer, after mechanical systems are completely installed and operating under normal load conditions and prior to final acceptance of the project, four (4) copies of tabulated report on each piece of mechanical equipment motor and motor starter. The tabulated reports shall show the following information:

1) Mechanical equipment identification on which motor and starter is used

2) Motor nameplate horsepower, full load amperes, and voltage

3) Motor nameplate service factor and temperature rise

4) Actual (metered) motor running amperes and voltage

5) Motor starter nameplate: HP rating and voltage

6) Motor starter thermal overload protection unit current rating, manufacturer's name and manufacturer's catalog number marked on thermal units.

3.4 OWNERS FURNISHED EQUIPMENT

A. Contractor shall provide the following for all equipment furnished by Owner or another trade:

1) All rough-ins for equipment and accessories;

2) Installation of loose trim provided with equipment by the Equipment Supplier;

3) Furnish and install all piping connections, valves, waste outlets, traps, unions, vacuum breakers, control valves, drains and other accessories as indicated on plans and as specified here within these specifications;

4) Make all final connections including but not limited to hot and cold water, sanitary waste and vent, indirect drains, and natural gas as required for complete and operational system as intended by these contract documents.

3.5 NOISE AND VIBRATION

A. Contractor shall be responsible for the installation of all equipment in such a manner as to control the transmission of noise and vibration from any installed equipment or system, so the sound level shall not exceed NC35, in any occupied space. Contractor shall be responsible for the correction of any objectionable noise in any occupied area due to improperly installed equipment.

3.6 INSPECTION

A. Each bidder shall inspect the site as required for knowledge of existing conditions and failure to obtain such knowledge shall not relieve the successful bidder of the responsibility to meet existing conditions in performing the work under the contract.

B. Where new work cannot be installed without changes to the existing facility, facility or systems or where it is indicated on drawings to rework an existing installation, this contract shall include alterations to existing work as required to install new work. Additions to the contract cost will not be allowed because of this Contractor's failure to inspect existing conditions.

3.7 TESTING

A. All electrical equipment furnished under this Division shall be adjusted and tested by this Contractor. Motors and other equipment furnished by others, to which electrical connections are made under this Division, shall be checked for short circuit and open circuits before energizing. Motors shall be checked for proper phasing and rotation. The thermal overload protection devices shall be checked in all motor starters, and equipment and all protection device size, motor nameplate full load amperage, and voltage rating for protection of the motor shall be listed (include equipment designation, rating of heater, motor nameplate horsepower, full load amps and voltage) and 4 copies of list shall be submitted to the Architect.

B. Mechanism of all electrical equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required. Adjustable parts of all lighting fixtures and electrical equipment shall be checked, tested and adjusted as required to produce the intended performance.

C. Completed wiring systems shall be free from short circuits and after completion, perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

D. The Contractor shall be held responsible for the operation, service and maintenance of electrical equipment during construction and prior to acceptance by the Owner. All electrical equipment shall be maintained in the best operating condition. Operational failure caused by defective material an/or labor furnished under this Division shall be immediately corrected. Architect shall be immediately notified of any operational failures caused by defective material and/or labor covered under other Divisions or furnished by others.

3.8 START-UP

A. All labor for the installation of material and equipment furnished under this Division shall be done by experienced mechanics of the proper trade and all workmanship shall be first class and in compliance with the specific requirements of drawings and specifications.

B. All material and equipment provided under this Division shall be installed under competent supervisory service furnished by the Contractor. Where necessary, this shall include the services of special erection and operation personnel.

C. The Contractor shall furnish all hoists, scaffolds, staging, runways, tools, machinery and equipment required for the performance of work.

D. Dirt and refuse resulting from the performance of the work shall be removed from the premises daily as required (broom clean) to prevent accumulation and the Contractor shall cooperate in the maintaining of reasonably clean premises at all times.

E. Immediately prior to the final inspection, Contractor shall clean all material and equipment. Dirt, refuse and stains shall be removed from all surfaces and damaged finishes restored to original condition.

3.9 TRAINING

A. The Contractor shall furnish all services as required for adequate verbal and printed instructions to the Owner and the Owner's operating and maintenance personnel for operation and maintenance of all equipment and systems installed under this Division. Three complete copies of service manuals in hardback binder shall be furnished at the end of the project in accordance with the General Conditions of the specifications. The manuals shall include printed operating and maintenance instructions for systems and equipment specified under this Division, all approved shop drawings and all manufacturer printed data.

B. When the work is complete and at a time designated by the Owner's designated Representative, the Contractor shall furnish the services of a qualified instructor to instruct the Owner's personnel in the operation and maintenance of the systems and equipment.

C. The bound copies of the operating and maintenance manuals shall be used during the verbal instructions.

END OF SECTION

SECTION 22 05 01 - PLUMBING PROJECT COORDINATION AND INSTALLATION

PART 1. GENERAL

1.1 VISIT TO SITE OF WORK

A. Visit site and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference shall be reported immediately to Owner/Consultant.

1.2 CONTRACTOR'S USE OF PREMISES

A. Confine operations at site to areas and limits permitted by law, ordinances, permits; Contract Documents and GENERAL CONDITIONS.

B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.

C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with Work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

D. Contractor shall pay for, or satisfactorily repair, all damages incident to their Work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this Contract.

PART 2. EXISTING FACILITY REQUIREMENTS

2.1 HAZARDOUS MATERIALS

A. Submit Material Safety Data Sheets for all materials furnished in this project defined as hazardous by NFPA. All requirements of the Material Safety Data Sheets shall be implemented and followed judiciously when hazardous materials are installed or otherwise used.

B. All hazardous materials shall be stored and used (mixed, applied, etc.) in strict accordance with the OSHA Standards, Safety Data Sheets and the Owner's Safety standards.

C. Refrigerants, nitrogen, welding gas, paints, varnish, volatile oils, etc., shall be stored in a room having good ventilation and containing no other material, or in metal lockers or barrels well away from structures or other combustible materials.

2.2 WELDING AND CUTTING

A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations. Before proceeding with any electric or gas welding or cutting or soldering work in or adjacent to the existing building the Contractor shall obtain a permit from either the Engineer or Owner. The permit shall be issued by its authorized supervisor or representative certifying compliance with conditions set out in the permit pertaining to welding and cutting operations.

END OF SECTION

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SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS 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. Flexible-hose expansion joints.
2. Pipe bends and loops.
3. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.

B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Welding certificates.

D. Product Certificates: For each type of pipe expansion joint, signed by product manufacturer.

E. Maintenance Data: For pipe expansion joints to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Flexible-Hose Expansion Joints: Manufactured assembly with two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.

1. Manufacturers:
a. Flexicraft Industries.
b. Flex-Pression, Ltd.
c. Metraflex, Inc.

2. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder joint end connections.

a. NPS 2 and Smaller: Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
b. NPS 2-1/2 to NPS 4: Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

3. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder joint end connections.
   a. NPS 2 and Smaller: Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
   b. NPS 2-1/2 to NPS 4: Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

2.2 ALIGNMENT GUIDES

A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

1. Manufacturers:
   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex-Weld, Inc.
   d. Metraflex, Inc.

2.3 MATERIALS FOR ANCHORS

A. Steel Shapes and Plates: ASTM A 36/A 36M.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
1. Stud: Threaded, zinc-coated carbon steel.
2. Expansion Plug: Zinc-coated steel.
3. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

B. Install expansion joints of sizes matching size of piping in which they are installed.

C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Attach pipe bends and loops to anchors.
1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

3.3 ALIGNMENT-GUIDE INSTALLATION

A. Install guides on piping adjoining pipe expansion fittings and loops.

B. Attach guides to pipe and secure to building structure.

3.4 ANCHOR INSTALLATION

A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.

D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.

E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION

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SECTION 22 05 19 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gauges.
4. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flo Fab Inc.
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.
2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle 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.
6. Window: Glass.
7. Stem: Stainless steel and of length to suit installation, including insulation thickness.
   a. Design for Thermowell Installation: Bare stem.
8. Connector: 1.25 inches, with ASME B1.1 screw threads, with adjustment of up to 180 degrees in vertical plane.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Type: Stepped shank unless straight or tapered shank is indicated.
4. External Threads: NPS 1/2, ASME B1.20.1 pipe threads.
5. Internal Threads: 0.5, with ASME B1.1 screw threads.
6. Bore: Diameter required to match thermometer bulb or stem.
7. Insertion Length: Length required to match thermometer bulb or stem.
8. Lagging Extension: Include on thermowells for insulated piping and tubing.
9. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin .

2.3 PRESSURE GAUGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ashcroft Inc.
    b. Trerice, H. O. Co.
    c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
2. Case: Liquid-filled Sealed type(s); cast aluminum; 4 inch normal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4, 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.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter to center of pipe 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 gauges in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gauges on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:

1. Incoming domestic water service.

K. Install pressure gauges 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.

L. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

M. Adjust faces of meters and gauges to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at incoming domestic water service shall be the following:
1. Industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.4 PRESSURE-GAUGE SCHEDULE

A. Pressure gauges at discharge of each water service into building shall be the following:

1. Liquid-filled, direct-mounted, metal case.

B. Pressure gauges at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Liquid-filled, direct-mounted, metal case.

C. Pressure gauges at suction and discharge of each domestic water pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.

3.5 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION

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SECTION 22 05 23 - PLUMBING VALVES

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Plumbing Valves:

1) Ball Valves
2) Gate Valves
3) Globe Valves
4) Check Valves
5) Plug Valves

B. Pressure and Temperature Relief Valves

1.2 QUALITY ASSURANCE

A. Valves shall be of the same manufacture throughout, where possible. Manufacturer's name and pressure rating shall be located on outside of valve.

B. Unless noted otherwise, cut-off valves shall be gate valves or ball valves or butterfly valves. Flow control (balancing) valves shall be ball valves or butterfly valves, except flow setting valves with metering connections shall be installed where indicated by symbol on drawings. Flow setting valves with metering connections, shall be provided and installed in accordance with Section 220524.

C. Cut-off valves used in water and water/glycol systems including chilled, process chilled, condenser, heating and process heating shall be ball valves for 2" size and smaller, and shall be butterfly valves 2½" size and larger. Valves used in steam and steam condensate lines shall be gate valves.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with General Requirements, Division 1, Section 013300, and as follows:

1) Submit copies of valve ordering schedule for approval before ordering valves.
2) Submit detailed shop drawings indicating make, model, location, type, size, and pressure rating.

PART 2. EQUIPMENT

2.1 BALL VALVES

A. Ball valves shall be manufactured to comply with MSS SP 110 and shall be 3-piece type. Valves shall be all bronze (B-584 or B-62) with stainless steel ball, full port and shall be designed for 150 PSI, 600 WOG; working temperature range of at least 0°F. to 300°F. Ball valves shall be three-section assembly with Double-O ring seal and removable center section with replaceable Teflon, TFE seats. Ball valves shall have blow-out proof stem with high extended stem to provide for insulating, lever type handle with vinyl grip and 90° stop on the extended stem. All valve stem housings shall be of length to receive up to 1½" thick insulation and shall have NIB seal valve extension.

B. Manufacturer

1) Ball valve manufacturers for plumbing applications
(a) Ball valves in water piping shall be NIBCO T595-66 or approved equal.
(b) Ball valves provided in compressed air piping shall be NIBCO T585-70-66 or approved equal.

2.2 GATE VALVES

A. Gate valves in plumbing piping 2" and smaller shall be bronze, rated at 125 psig-swp and provided with a solid stem, union bonnet, split wedge, and screwed ends.

1) Gate valves in copper tubing for plumbing applications shall be bronze, rated at 300 psig-wog and provided with a non-rising stem, screwed bonnet, solid wedge, and solder ends.

2) Gate valves in plumbing piping 2½" and larger shall be iron body, bronze mounted rated 125 psig-swp and provided with outside screw and yoke and flanged ends.

3) Manufacturers for plumbing applications:
   (a) Gate valves in plumbing piping 2" and smaller shall be Stockham B-105.
   (b) Gate valves in copper tubing for plumbing applications shall be Stockham B-108.
   (c) Gate valves in plumbing piping 2½" and larger shall be Stockham G-623.

2.3 GLOBE VALVES:

A. Globe valves in piping 2" and smaller shall bronze, rated at 150 psig-swp and provided with a union bonnet, composition disc and screwed ends.

B. Globe valves in copper tubing shall be bronze, rated at 300 psig-wog. and provided with a screwed bonnet, composition disc, solder ends.

C. Globe valves in piping 2½" and larger shall be iron body, bronze mounted, rated at 125 psig-swp and provided with a composition disc, outside screw and yoke and flanged ends.

D. Manufacturer

1) Globe valves in piping 2" and smaller shall be Stockham B-22.
2) Globe valves in copper tubing may be Stockham B-14T.
3) Globe valves in piping 2½" and larger shall be Stockham G-514T.

2.4 CHECK VALVES

A. Swing check valves in piping 2" and smaller shall be Stockham B-319, or NIBCO T413-Y, bronze, rated at 125 psig-swp and provided with a bronze disc and screwed ends.

B. Swing check valves in copper tubing may be Stockham B-309, or NIBCO F918-B, bronze, rated at 125 psig-swp and provided with flanged ends.

C. Swing check valves in piping 2½" and larger shall be Stockham G-931 or NIBCO F918-B iron body, bronze mounted, rated at 125 psig-swp and provided with flanged ends.

D. Checks in vertical piping shall be Jenkins 119, or approved equal, with bronze bodies and bronze discs guided at top and rated at 150 psig-swp.

2.5 PLUG VALVES

A. Materials: 175 psi, eccentric design, cast iron ASTM A 126 Gr. B body, grooved ends, ductile iron ASTM A 536 plug encapsulated with a resilient material, self lubricating, multiple packing ring stem seal, welded in nickel overlay seats, and lever or gear operator.

B. Manufacturers: Stockham or NIBCO.

2.6 PRESSURE & TEMPERATURE RELIEF VALVES

A. Material - Pressure and temperature relief valves shall designed, constructed and rated to ASME Code. Valves shall have a capacity at pressure indicated on drawings, in Btu's/Hr. of not less than capacity of units which they protect and they shall have test levers. Extend relief line full size and end over drain.

B. Manufacturer

1) Watts
2) McDonnell

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Valves shall be installed within each system to provide the required flow control and to provide isolation for inspection, maintenance and repair of each piece of equipment and each main and branch service loop. The foregoing shall apply whether or not valves are shown on drawings. Valves shall also be installed in other locations shown on drawings. Each valve shall be installed so as to be easily accessible for operation and visual inspection after construction is complete.

1) A union connection shall be installed within two feet and on each end of a screw end valve (Reference Section 221119 for piping unions). Valves and specialty items shall be rated for not less than the cold water working pressure and the test pressure specified for each piping system.

END OF SECTION

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SECTION 22 05 29 - PLUMBING SUPPORTS, ANCHORS AND SEALS

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Piping Hangers and Supports

B. Roof Mounted Curbs and Equipment Supports

PART 2. EQUIPMENT

2.1 PIPING HANGERS AND SUPPORTS

A. Provide factory-fabricated horizontal piping hangers, clamps, attachments and supports in compliance with ANSI SP-69 and ANSI SP- 89. Select hangers and supports sized to exactly fit pipe size for bare piping, and to exactly fit around pipe insulation with saddle and shield for insulated piping. Hangers in contact with copper pipe shall be copper plated.

B. Unless specified otherwise, pipes shall be hung with malleable iron, split ring hangers or clevis hangers not less than 1/8" thick. Strap type hangers shall not be acceptable. Roller type hangers shall be used where required or shown to allow for movement of pipes by expansion. Hangers shall have rods and turnbuckles of required length. Suspension shall be from suitable steel supports fastened to overhead construction or steel wall brackets. Hangers and supports shall be installed so that pipes are run parallel and evenly spaced.

C. Anchors in concrete construction shall be threaded compound type or Phillips self-drilling type of sufficient size to adequately support the load.

D. Manufacturer:

1) Hangers and supports:
(a) Mason Mfg. Co.
(b) Kindorf Mfg.
(c) Unistrut Mfg., Inc.
(d) Fee Mfg.

2) Saddles and shields:
(a) Pipe Shields, Inc.

2.2 ROOF MOUNTED CURBS AND EQUIPMENT SUPPORTS

A. Curbs and equipment supports for roof mounted equipment shall be of monolithic construction, not less than 18 ga. galvanized steel, with continuous welded corner seams, factory installed wood nailer, built-in raised cant of height as required for thickness of roof insulation, and base as required for attaching to the roof structure.

B. Curbs shall be internally insulated with 1½" thick, 3 lb. density rigid glass fiber board and shall have galvanized sheet metal liner. Equipment supports shall have integral base plate, wood nailer, and 18 gauge galvanized steel flashing cap.

C. Curbs and equipment supports shall be of size as required to properly mate with equipment to be mounted on the curbs or supports and shall be designed and constructed to safely support the weight of the equipment. The height of curbs shall be as indicated on drawings, but not less than 13½" high above the roof deck, unless called for or specified otherwise.

D. The curbs and supports shall be securely attached to the roof structure to withstand wind pressures on the vertical surface of the curb or supports and the mounted equipment by wind velocities up to 100 MPH. The complete installation shall be made watertight and shall be coordinated with the roofing installer.

E. Manufacturers:

1) Roof Curbs
(a) Pate Manufacturing Company: PC-2
(b) Thycurb
(c) Custom Curb

2) Equipment Supports
   (a) Pate Manufacturing Company: ES-5A
   (b) Thycurb
   (c) Custom Curb

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Comply with MSS SP-69 and SP-89 for installation of hangers, supports and anchors. Install hangers, supports, clamps, and attachments directly from building structure complete with inserts, bolts, rods, nuts and washers, and washers, and accessories. Do not use wire or perforated metal to support piping; pipe support from other piping shall not be permitted. Install hangers with minimum ½" clear space between finished covering and adjacent work. Place hanger within 1 foot of each horizontal elbow. Use hangers vertically adjustable 1½" minimum after piping is erected.

B. Insulated pipe, hangers and supports shall be furnished with ribbed galvanized steel shields of not less than 18 gauge; two-piece pre-molded, high compressive strength, insulation inserts (360° around pipe); and vapor barrier jacket covering the insulation inserts. Inserts shall be constructed of high density, 100 psi, waterproofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

C. Maximum spacing of hangers and supports shall be in accordance with the following schedule for size of pipe:

Pipe Size	Rod Size	Ferrous Pipe	Copper Pipe	Plastic Pipe
½" & ¾"	¼"	8'-0"	6'-0"	4'-0"
1" & 1¼"	3/8"	9'-0"	7'-0"	4'-6"
1½"	3/8"	9'-0"	8'-0"	5'-0"
2" & 2½"	3/8"	10'-0"	9'-0"	5'-0"
3" & 4"	5/8"	10'-0"	10'-0"	6'-0"
6" to 12"	7/8"	14'-0"	7'-0"	
14" to 18"	1"	20'-0"		

D. Hangers for cast iron pipe shall be installed on maximum 5'-0" centers.

E. Supports on masonry walls shall have bolts through wall fastened to suitable steel plate on back of wall. Where required to allow for movement of pipe by expansion due to short hanger rods, pipes shall rest on rollers and covering protection saddles. All piping shall be supported and secured as required to prevent vibration and the transmission of noise and lateral movement.

F. The Contractor shall furnish and install all necessary material, hangers and support including all structural steel members and shapes to substantially support and/or suspend all piping and equipment, in an approved manner. Perforated strap hangers will not be acceptable.

   1) Drive screws, pins, studs, etc., which are secured in place by means of explosive force will not be permitted.

   2) Except as specifically otherwise approved, no item of equipment shall support any pipe or duct nor shall any item of equipment be supported on any pipe or duct.

G. Hangers shall be provided at every item of equipment and at every change in direction or branch connection to every pipe.

H. All pipes through roof shall be installed with sleeves and openings, and with roof flashing/counterflash assembly or pipe curb assembly as herein specified. The complete installation shall be coordinated with the roofing installer and shall be watertight and weather tight.

I. Sleeves shall be steel pipe and shall be installed for single pipe installation. Openings shall be boxed out for multiple installations. Sleeves for acid waste vent stacks shall be installed as specified under the heading: Sleeves and Openings.

J. Single, un-insulated pipes through roof shall be installed with flashing/counterflashing assembly with four pound seamless lead flashing assembly with 8" high boot and not less than 8" skirt. A

conical shaped steel reinforcing boot underneath lead flashing assembly shall also be installed. Cast iron counterflashing fitting with rust-resistant prime coat, of the caulking type to fit over all types of piping, vandal-proof set-screws for anchoring in place, and top annular space for sealant fill shall also be installed for single, un-insulated pipes. Assemblies shall be furnished in sizes to properly fit size of pipe with which they are installed. Flashing assembly shall be designed to fit properly on roofs from level up to 20° pitch. Top of flashing cone shall be sealed before installing counterflash fitting. Annular space in top of counterflash fitting shall be completely filled with epoxy sealing compound.

K. Grouped multiple pipes through roof and insulated pipes through roof shall be installed with factory prefabricated metal curb assembly of unitized construction of not less than 18 ga. galvanized steel with base plate for anchoring to roof deck or roof slab. The cant base for roof insulation thickness shall match the thickness of insulation where it is to be installed. A wood nailer strip shall be installed on top of the curb, and shall have 1½" thickness of 3 lb. density fiberglass insulation on inside, and not less than 11" high from base to top of wood nailer. The curb assembly shall also have an acrylic clad ABS plastic flashing cover with number and size of formed openings as required for the number and size pipes through roof, along with a graduated step neoprene boot for each pipe. A neoprene boot shall be secured around pipe and around formed opening in flashing cover with stainless steel clamps for waterproof connections. Insulation on insulated pipes shall be continuous through the curb, flashing cover, and the neoprene boot. After roofing is flashed up over the curb and secured in place, the ABS plastic flashing cover shall be installed over curb and flash roofing and anchored in place for a watertight and weather tight installation.

L. Furnish and set all boxouts for openings and all sleeves for work to be installed under this division. Sleeves shall be installed for all pipes passing through floors, walls, and partitions. All sleeves shall be set tight in construction, without space between the sleeve and construction. Sleeves through walls and partitions shall be flush at each end and sleeves through floor shall extend 2" above finished floor unless indicated otherwise.

M. Sleeves through concrete slabs, concrete walls, and bearing masonry walls shall be steel pipe of not less than Schedule 30. Sleeves through non-bearing wall and partitions may be Schedule 10 pipe or 22 ga. sheet steel with formed bead on each end.

N. The annular space around bare pipes and pipe insulation on insulated pipes through sleeves shall be packed tightly with mineral wool to prevent transmission of air and sound. Each end of sleeve at floors and through fire-rated walls shall also be sealed with 1" thickness of waterproof and fireproof caulk equivalent to 3M #CP25 fireproofing caulk.

O. Each Contractor shall provide all structural steel and materials necessary to properly support and anchor equipment and lines provided under this contract.

P. All equipment and materials shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and suitable for the service required.

Q. Concrete bases shall be provided where shown on the drawings. Equipment which is to be grouted in place shall be grouted with Embeco or approved non-shrink grout.

END OF SECTION

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SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Identification for:

1) Piping systems
2) Valves
3) Equipment
4) Warning signs
5) Painting

1.2 SUBMITTALS

A. Submit shop drawings in accordance with General Requirements, Division 1, Section 013300.

B. Submit copies valve schedule for each piping system, typewritten and reproduced on bond paper. Tabulate valve number, piping system, system abbreviation, location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses, by special "flag", in margin of schedule. Include valve schedules within Maintenance Manuals (Re: 220100) and Division 1.

PART 2. EQUIPMENT

2.1 IDENTIFICATION MATERIALS

A. Valve tags: 19 gauge polished brass, 1-1/4" diameter, stamp engraved black enamel fitted. Valve tag fastener shall be solid brass chain.

1) At Contractors option, valve tags may be 3/32" thick engraved plastic laminated valve tags, within piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high letters, and with 5/32" hole for fastener. Valve tag shall be white with black lettering.

B. Valve schedule frames: For each page of valve schedule, provide glazed display frame with screws for removable mounting on masonry walls. Frame shall be extruded aluminum with SSB-grade sheet glass.

C. Engraved plastic-laminate signs: Engraving stock melamine plastic laminate; sizes and thicknesses indicated; engraved with engraver's standard letter style of sizes and wording indicated; punched for self-tapping stainless steel fasteners. Laminated signs thickness shall be 1/16" for units up to 20 sq.in. or 8" length and 1/8" for larger units. Laminated tags and signs shall be color coded, conforming to the following color code:

1) Yellow: Heating equipment and components.
2) Green: Monitoring (space temperature and humidity)
3) White: Equipment and components that do not meet any of the above criteria.
4) Red: Warning or Danger.

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.

E. 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.

F. Lettering Size: At least 3/4 inches high.

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 PIPE LABEL INSTALLATION

A. 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7) On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule shall be per the following table:

Pipe System	Legend	Letter Color	Background Color
Softened Water	SFT	White	Green
Potable Cold Water	CW	White	Green
Potable Hot Water	HW	Black	Yellow
Potable Hot Water Circulation	ICW	Black	Yellow
Fire Protection	FP	White	Red
Natural Gas	NG	Black	Yellow
Roof Drain Piping	RD	Black	Green
Waste	W	Black	Green
Grease Waste	GW	Black	Green
Vent	V	Black	Green

3.3 UNDERGROUND PIPING IDENTIFICATION

A. During back-filling/top soiling of exterior underground piping system, install a continuous plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench, and do not exceed overall width of 16", install single line marker.

3.4 VALVE IDENTIFICATION INSTALLATION

A. Valve tag location: Provide valve tag on all valves, cocks, and control devices in each piping system. List each tagged valve in valve schedule for each piping system. Mount valve schedule frames and schedules in machine room where directed by Owner's Representative.

3.5 EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate signs except where lettering larger than 1" is required for proper identification. Locate signs in or near each piece of mechanical equipment and each operation device.
   1) Provide plastic laminated signs at main control and operating [valves, pumps, meters, gauges, thermometers, control devices, and sensors].
   2) Laminated tags, at a minimum, shall be provided for each piece of equipment scheduled on drawings.

B. All temperature sensors, differential pressure switches, and control devices integrated with the building control systems shall be permanently marked to indicate normal operating points or

range for both summer and winter operation. Coordinate with Engineer and Owner prior to marking. In addition, all room sensors shall have laminated tags mounted adjacent to the room sensor on wall or within the cover of the sensor itself. The laminated tag shall indicate the device which the sensor serves.

3.6 WARNING AND DANGER SIGNS

A. Where identifications signs are required to indicate a warning or danger, signs shall be plastic laminated with red background and white lettering. At a minimum warning signs shall be provided as follows:

1) All motor driven equipment that automatically starts shall include a warning sign indicating such. Coordinate wording of danger sign with facility manager.

3.7 PAINTING

A. All exposed steel, including structural members for mechanical equipment, piping, structural steel bases, and all other non-ferrous metals, shall be painted with a high solids epoxy coating manufactured by Ameron - Amerlock-400 or approved equal. Apply epoxy coating in accordance with manufacturers written instructions.

B. All painting that will be exposed to weather shall be painted with Aliphatic Polyurethane manufactured by Ameron - Amersheild or approved equal. All painting shall be applied in accordance with manufacturers written instructions.

END OF SECTION

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SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Piping Insulation (Glass Fiber Type)

1.2 RELATED DOCUMENTS

A. American Society for Testing and Materials

1) Flame Spread: 25 or less; ASTM E84, NFPA 255
2) Smoke Developed: 50 or less; ASTM E84, NFPA 255

1.3 QUALITY ASSURANCE

A. Insulation shall not be applied until all piping has been tested and approved and thoroughly cleaned. All insulation work shall present a neat appearance with smooth and uniform surfaces. Work done in a slovenly manner will not be acceptable. All insulation joints shall be carefully fitted and tightly butted. All jacket materials shall be neatly applied with smooth surfaces and shall be securely adhered or pasted in place. All seams and joints shall be located so that they are as inconspicuous as possible. Exposed edges and ends of all insulation shall be sealed and finished to provide a complete, unbroken vapor seal. The Contractor shall install insulation to be continuous through pipe sleeves.

B. Failure, due to faulty workmanship or material, of any portion of the installed insulation to perform the function as intended by these specifications, either stated or implied, for a period of one (1) year after acceptance of the project by the Owner, shall be the responsibility of the Contractor and shall be rectified at no additional cost to the Owner. This shall include the loosening of any jacket material, the appearance of condensation on the outside of the insulation, or any other mechanical or thermal failure which affects either appearance or efficiency of installation.

1.4 SUBMITTALS

A. Submit shop drawings for all insulating materials in accordance with Division 1.

B. Shop Drawings:

1) Submit shop drawings which indicate complete material data, mastics, adhesives, list of materials proposed for this project and indicate thickness of material for individual services.

C. Product Data:

1) Provide current manufacturer's data to show compliance with these specifications and governing regulations; include proof of compliance for test products of products for fire and smoke rating, corrosiveness and compressive strength.

PART 2. EQUIPMENT

2.1 PIPE INSULATION (GLASS FIBER TYPE)

A. Material – Pipe insulation including fittings and devices, unless specified otherwise, shall be insulated with 1-piece rigid molded glass fiber, 4 lbs/cu ft density with a K value of 0.22 at 75°F. The insulation shall be suitable for temperatures of –40° to 450°F, and with longitudinal flap, butt joint end strips and factory applied pressure sealing lap adhesive.

B. Manufacturers:

1) Insulation:
(a) Certain-Teed: CSG Snap-On ASJ-SSL Products
(b) Knauf: Pipe Insulation
(c) Manville Corp.: J-M Micro-Lok, 650 APT
(d) Owens-Corning: One-Piece Fiberglass 25

2) Fitting Covers:
(a) Certain-Teed: Snap-On Products

(b) Insul-Coustic: Insul-Sure Heavy Density Birma
(c) Manville Corp.: Zeston, One Piece Pre-molded
(d) PVC Cover with Fiberglass Insert.

2.2 PVC JACKETING

A. Provide PVC Jacketing on all pipe insulation located below the ceiling line in non-mechanical spaces. Cover pipe fittings and other equipment from an outside diameter of 1-5/8" to 24" in accordance with ASTM C-585.

B. PVC jacketing material shall be gloss white outdoor and spray down weatherable. Fittings, unique shapes fit screwed, welded and flanged elbows, tees, valves, couplings, laterals, reducers and end caps. The Jacketing shall be.020" minimum thicknesses. The Jacketing and Fitting Covering Systems include solvent weld adhesives, stainless steel tack fasteners, silicone caulking and adhesive tapes. A die-cut multi-temperature fiberglass insulation insert is available and sized for a full insulation over the exposed pipe fitting and under the overlay of the PVC Fitting Cover.

1) Code Compliance: PVC Fitting Covers and Jacketing meet: Military Specification LP-1035A, Type 11 Grade GU and Type 111, and LP-535E, Type 11 Grade GU and Type 111. Federal Specification HH-I-558, Form B, Type 1 Class B. Requirements of USDA and FDA for use in facilities of the food processing, beverage and pharmaceutical industries. PVC jacketing 25/50 fire class per ASTM E-84. Thermal conductivity of 0.26 BTU/hr/sq ft/°F/In

2) The system shall have an applicable temperature range of -35°F to 500°F (-37°C to 260°C).

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Systems shall be completely covered throughout, including valves, fittings and accessories. Strainer covers and valve bonnets shall be accessible for maintenance. Unless specified otherwise, insulation shall extend continuous through sleeves. Where pipe covering terminates at ceilings, wall and equipment, furnish and install covering protector cups fastened to covering. Cups shall be Zeston polyvinyl chloride (PVC), or approved equal.

B. All adhesives, tape and any other material used for sealing shall be applied in strict accordance with manufacturer's instructions which includes covering rate of application, method of application, temperature limits for application of said materials, or any other condition affecting efficiency or permanence of the installation.

C. Where pipe hangers are present, insulated pipe shall be furnished with ribbed galvanized steel shields of not less than 18 gauge, two-piece pre-molded, high compressive strength, insulation inserts (360° around pipe), and vapor barrier jacket covering the insulation inserts. Inserts shall be constructed of high density, 100 psi, waterproofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

D. Service access shall be provided through insulation where required. Insulation at flanged joints shall be designed to permit removal of flange bolts and nuts. Insulation for removable flanges of cold pipe strainers shall be fabricated with built-up sections of fiberglass pipe covering arranged to facilitate servicing of the strainer. Applications shall be complete with vapor seals.

3.2 PIPE INSULATION (GLASS FIBER)

A. Installation shall be in strict accordance with the manufacturer's instructions. Jacket shall have finish so as not to require field painting, but shall be suitable for field painting if desired.

B. Fittings, valves and accessories shall be insulated with PVC fitting covers with glass fiber inserts to provide same insulating values as the pipe insulation in locations where piping is exposed to view. Strainer covers and valve bonnets shall be accessible for maintenance. Fitting covers on "cold" pipe requiring vapor barrier jackets shall be installed vapor tight using adhesive and "Z"-tape applied to the circumferential joints, overlapping the fitting cover and adjacent insulation jacket. No tacks shall be used on vapor tight fitting covers.

C. Where piping is concealed by construction, the fittings, valves, and accessories shall be insulated with PVC covers as specified for exposed piping. Strainer covers and valve bonnets shall be accessible for maintenance.

D. Use of staples is prohibited, except staples may be used in the longitudinal joints. If after staples are installed, the entire longitudinal joint shall be covered with 3" wide adhesive backed strip to match insulation jacketing to cover staples and securely attached.

E. Piping to be insulated and thickness of insulation shall be as follows:

Piping Insulation Thickness

Piping System	Pipe Sizes	Thickness
Domestic Cold Water & Hot Water	Thru 2" 2½" & Larger	1" 1½"
Roof Drain	All	1”

3.3 ACCESSORIES

A. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers recommended by insulation manufacturer for application indicated. Do not use staples on cold water insulation. Provide adhesives, cements, sealers, mastics and protective finishes recommended by insulation manufacturer for application indicated.

3.4 OUTDOOR PROTECTION

A. All outdoor insulation shall be covered with a weather protective jacket consisting of 22 gage aluminum or 26 gage stainless steel protective covering. Edges of exterior jacket shall be securely closed around insulation to prevent rain, snow, dirt, etc. from damaging the underlying insulation in any fashion.

END OF SECTION

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SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Escutcheons.
6. Sleeves and sleeve seals.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Material 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.

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. 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.

2.3 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "Plumbing Valves" 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.

2.4 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 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.

D. 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.

2.5 FLEXIBLE CONNECTORS

A. 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.

2.6 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

2.7 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

B. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.8 SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe 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.

2.9 GROUT

A. Standard: ASTM C 1107, 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 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 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.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices as required by local authority.

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 unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. 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.

T. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

U. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.2 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. 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.

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 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 valves for piping NPS 2 and smaller. Use butterfly 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 flow control valve in each hot-water circulation return branch and discharge side of each pump and circulator. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for 2 inches and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for 2.5 inches and larger: Use dielectric flanges.

3.5 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Plumbing Supports, Anchors and Seals" 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.
3. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 0.375-inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters per schedule listed in Division 22 Section “Plumbing Supports, Anchors, and Seals”.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 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 and backflow prevention device as shown on plans; 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.

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.9 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 0.25-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
    a. Extend sleeves 2 inches above finished floor level.
    b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
3. Sleeves for Piping Passing through Gypsum-Board Partitions:
    a. Steel pipe sleeves for pipes smaller than NPS 6.

b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

4. Sleeves for Piping Passing through Exterior Concrete Walls:

a. Steel pipe sleeves for pipes smaller than NPS 6.
b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

L. 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 in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.10 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Plumbing Identification" for identification materials and installation.

3.12 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. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. 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.

3.13 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.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three (3) 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. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 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: Flow control 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 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 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. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.
11. Trap-seal primer valves.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. 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."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Rain Bird Corporation.
   e. Toro Company (The); Irrigation Div.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Plumbing Products Group; Wilkins Div.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. Prier Products, Inc.
   d. Watts Industries, Inc.; Water Products Div.

e. Woodford Manufacturing Company.
f. Zurn Plumbing Products Group; Light Commercial Operation.
g. Zurn Plumbing Products Group; Wilkins Div.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. FEBCO.
   b. Watts Industries, Inc.
   c. Zurn Plumbing Products Group.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
4. Body: As Scheduled.
5. End Connections: As scheduled.
6. Configuration: Designed for flow direction as required in drawings.
7. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke 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.
   c. All accessories as scheduled and/or detailed on drawings.

B. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. FEBCO.
   b. Ames.
   c. Watts Industries, Inc.
   d. Zurn Plumbing Products Group.
2. Operation: Continuous-pressure applications, unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Body: As Scheduled.
5. End Connections: As Scheduled.
6. Configuration: Designed for flow direction as indicated on drawings.
7. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
   b. All accessories as schedule and/or details on drawings.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cash Acme.
   b. Honeywell Water Controls.
   c. Watts Industries, Inc.
   d. Zurn Plumbing Products Group.
2. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
3. Valves for Booster Heater Water Supply: Include integral bypass.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Armstrong International, Inc.
    b. Leonard Valve Company.
    c. Powers; a Watts Industries Co.
    d. Symmons Industries, Inc.
2. Pressure Rating: 125 psig.
3. Type: Exposed-mounting, thermostatically controlled water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded union inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
8. Reference drawings for temperature, flow and pressure requirements.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Drain: Factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Body Material: Bronze.
2. Seat: Bronze, replaceable.
3. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
4. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
5. Pressure Rating: 125 psig.
6. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
7. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
8. Finish for Service Areas: Rough bronze.
9. Finish for Finished Rooms: Chrome or nickel plated.
10. Operation: Operating key.
11. Include operating key with each operating-key hose bibb.
12. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Woodford Manufacturing Company.
    f. Zurn Plumbing Products Group.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.

12. Operating Keys(s): Two (2) with each wall hydrant.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. Sioux Chief Manufacturing Company, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sioux Chief Manufacturing Company, Inc.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Industries, Inc.; Water Products Div.
3. Standard: ASSE 1018.
4. Pressure Rating: 125 psig minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

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 (2) 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 unless otherwise indicated.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. 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.

F. Install Y-pattern strainers for water on supply side of each control valve and pump.

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. 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.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

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SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

1.2 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.

1.3 SUBMITTALS

A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
   1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
   1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
      a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Solid-Wall PVC Pipe: ASTM D 2665.
   1. PVC Socket Fittings: ASTM D2665, Socket type, made to ASTM D 3311 drain, waste, and vent patterns.
   2. Solvent cement and adhesive primer:
      a. 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).
      b. 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).
   3. The use of PVC drain, waste, and vent piping is only allowed below grade, when temperature of water to be drained does not exceed 140 degrees Fahrenheit.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

3.2 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 cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

E. 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 (two) 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.

F. 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.

G. 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.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. 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 valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.4 HANGER AND SUPPORT INSTALLATION

A. Install hangers and supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Support vertical piping and tubing at base and at each floor.

C. Install supports for vertical cast-iron soil piping every 15 feet.

D. Support piping and tubing according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. 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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
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.

3.6 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.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.7 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.

END OF SECTION

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SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   4. Miscellaneous sanitary drainage piping specialties.
   5. Flashing materials.
   6. Grease interceptors.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group.
   2. Size: Same as connected drainage piping
   3. Provide with body, closure, and plug equal to as scheduled on drawings.

B. Cast-Iron Floor Cleanouts:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group.
   2. Size: Same as connected branch.
   3. Type, body, frame, and cover equal to as scheduled on drawings.

2.2 FLOOR DRAINS/FLOOR SINKS

A. Cast-Iron Floor Drains:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group.

2. Size: Same as connected branch, unless noted otherwise.

3. Type, body, frame, and cover equal to as scheduled on drawings.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 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.

2.4 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.
2. Size: Same as connected waste piping [with increaser fitting of size indicated].

B. 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.

C. 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 1/2 side inlet.

D. 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.

E. 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] [2 inches] 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.

F. 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.

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 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 4 and smaller and 100 feet for larger piping.
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 and floor sinks at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated. Block out floor prior to pouring of concrete and then level floor drain after power is set, remove forms and grout hole level.

1. Position floor drains and floor sinks for easy access and maintenance.
2. Set floor drains and floor sinks 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 0.25-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 roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Assemble open drain fittings and install with top of hub 2 inches above floor.

J. Install deep-seal traps on floor drains and other waste outlets, if indicated.

K. 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.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. 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.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 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 Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 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.

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.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

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 "Plumbing Identification."

3.5 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

SECTION 223300 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Commercial, storage electric water heaters.
   2. Water heater accessories.

1.2 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

D. Warranty.

1.3 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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

D. ASHRAE/IESNA 90.1 for United States Department of Energy standby loss requirements.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period(s): From date of Substantial Completion:
      a. Commercial Electric Water Heaters: Three years.

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.

B. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
   1. Manufacturers:
      a. Bradford White.
      b. Rheem/Ruud.
      c. A.O. Smith.

d. State.

2. Storage-Tank Construction: Non-ASME-code, steel vertical "low-boy" arrangement.
   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
      1) Staging: Input not exceeding that as listed on schedule.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Capacity and Characteristics:
   a. Capacity: Per Schedule.
   b. Recovery: Per Schedule.
   c. Temperature Setting: 120 deg F.
   d. Number of Heating Elements: Per Schedule.
   e. Electrical Characteristics: Per Schedule.

2.2 WATER HEATER ACCESSORIES

A. Water Heater Suspension platform and integral drain pan: As listed in schedule and details for suspension of water heater above janitor's sink. Include dimension that will support bottom of water heater as high as possible within janitor's closet. Suspension platform shall be constructed of corrosion resistant metal with raised edge, with drain outlet not less than ¾".

B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

C. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 50-psig maximum outlet pressure, unless otherwise indicated.

D. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

E. Expansion Tanks: As listed in schedule and noted on drawings.

F. Recirculation Pumps: As listed in schedule and noted on drawings.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. 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.

C. 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 water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

D. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

E. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

F. Fill water heaters with water.

3.2 CONNECTIONS

A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

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. Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.

B. Perform the following field tests and inspections:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

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SECTION 22 42 00 - PLUMBING FIXTURES AND ACCESSORIES

PART 1. GENERAL

1.1 WORK INCLUDED

A. This Specification, together with the accompanying drawings, is intended to be the means of requiring this Contractor to provide all labor, materials, tools, equipment, services and weather protection required for the complete installation, ready to operate of "Plumbing Work" as shown on the drawings and specified herein.

B. Furnish and install as shown on the drawings and as specified herein.

1) Sanitary Drainage System consisting of all piping, floor drains, hub outlets, plumbing fixtures and trim, cleanouts, vents, etc..

2) Domestic Cold Water Supply System consisting of all piping, backflow preventers, pressure reducing valves, flow meters, valves, insulation, hose bibbs, thermal expansion absorber, etc., and connect as shown on the drawings and as required. Extend to all plumbing fixtures, and equipment requiring water.

3) Waste Systems

(a) Clearwater waste systems consisting of all piping, including HVAC condensate, untreated cooling tower water, and ice machine discharge, complete with cleanouts, hub outlets, traps, etc., and connecting to existing system as shown on drawing, per approval of local administration. Discharge must exclude sanitary flow.

(b) Relief Valves Discharge piping to direct discharge from relief valves to a drain or location in which scalding hot water is unlikely to strike people and discharge without property damage due to flooding.

4) Storm Drainage Systems

(a) Drainage systems work shall consist of coordination of locating all aboveground and underground piping, drains and pipes passing through walls and roofs.

(b) Roof drainage, consisting of locating, setting and flashing roof and overflow drains sumps, installation and connecting of roof drains, overflow drains, horizontal conductors, vertical downspout and leaders, cleanouts, and coordinate installation with roofing contractors.

(c) Overflow drains shall be piped separately from the primary system to a separate disposal point so that blockage of the primary drainage will not affect the effective of the overflow drainage system. Means for disposal of the overflow drain discharge must meet the requirements of the local codes. Open discharge on the street may not be allowed, especially in northern climates.

(d) Site drainage, consisting of location and installation of area drains, footing drainage, sump drains and pumps, inlets, catch basins, manholes and cleanouts.

5) Building Drains

(a) Floor Drains - Furnish and install all work incidental to the foregoing items to be performed under this contract, such as:

(b) All plugged tee and valved outlets

(c) All cutting and patching of work of any nature unless otherwise specified herein

(d) All pipe and equipment hangers, platforms, support bases, anchors, guides, expansion loops, vibration eliminators, etc., unless otherwise specified herein

(e) All required final connections to equipment

(f) All cleaning, disinfecting and testing

1.2 REGULATORY REQUIREMENTS

A. The entire plumbing installation shall comply fully with requirements of all applicable State and local laws, codes and ordinances.

B. The work shall also comply with all applicable requirements of the National Fire Protection Association (NFPA), Occupational Safety and Health Act (OSHA), the 2006 Uniform Plumbing Code

(UPC)], Providing Accessibility and Usage For The Physically Handicapped People (ANSI A117.1) and the Environmental Protection Agency (EPA).

C. A reference to an ANSI or ASTM Standard shall indicate that the article shall conform to that standard in all respects (including material, manufacture, handling, dimensions, and test procedure).

1.3 SUBMITTALS

A. Submit shop drawings in accordance with General Requirements, Division 1, Section 01300, and as follows:

1) Submit catalog data and descriptive literature, as applicable, for all equipment, fixtures, and specialty items in accordance with the Conditions of the Contract and obtain approval of materials before delivery to job site.

2) Shop drawings shall be coordinated with equipment supplied by other Contractors and the Owner.

3) Submit a bound copy of all approved shop drawings, together with complete parts lists and operating and maintenance instructions for all equipment furnished under this Section.

1.4 JOB CONDITIONS

A. Inspect existing site conditions affecting the work before submitting bid.

B. Take all measurements for plumbing work and shop drawings with all other contractors affected and make any necessary offsets required to conceal piping and to clear equipment, structural members and other obstructions.

C. Protect all work, materials, fixtures and equipment from damage. Cap or plug temporary openings. Deliver all work to the owner clean and in perfect condition. Keep work areas clear of debris. Promptly remove waste material from the premises.

1.5 GUARANTEE

A. The contractor guarantees all plumbing work against any defects due to faulty workmanship or material and that all piping is free from foreign material, obstructions, holes or breaks of any nature.

B. The contractor guarantees the proper circulation and/or drainage of fluid in each piping system.

C. Upon written notice from the Architect or Owner, the contractor shall promptly remedy, without cost to the Owner, any defects occurring within a period of one (1) year from the date of final acceptance.

1.6 CLEANING AND DISINFECTING

A. Piping systems shall be cleaned and disinfected as hereinafter specified. All equipment, temporary piping, chemicals, etc., as required shall be furnished by the Contractor.

1) Domestic Water Systems: All system piping and equipment shall be thoroughly and completely flushed with cold city water. Completely drain the systems and fill with a solution of Sodium or Calcium Hypochlorite, 100 parts per million, completely relieve the system of all air. Allow the solution to stand for eight (8) hours and then drain and follow with a clear water flush for a sufficient period of time to remove all traces of hypochlorite odor. Disinfecting chemicals shall not be introduced into existing piping systems.

B. Immediately prior to final inspection the Contractor shall make a final cleanup of dirt and refuse resulting from his work and shall make the premises broom clean. The Contractor shall clean all material and equipment installed under the contract. Damaged finishes shall be touched-up and restored to their original condition.

1.7 PIPING TESTS

A. All piping shall be tested, leaks repaired and systems retested until proven tight before backfilling, concealing or insulating pipe.

1) Test drainage and vent systems with water or air in accordance with requirements of the Uniform Plumbing Code and all applicable local Codes. Water test may be applied to entire drainage systems or sections of systems. All openings shall be tightly closed in section to be tested except at highest opening. All portions of systems shall be subjected to a minimum of 10 feet head of water. Water must have been in the system 15 minutes prior to inspection. Air test in accordance with the Uniform Plumbing Code may be used at Contractor's option.

2) Hydrostatically test entire domestic water system to 100 psig or higher pressure as required by local Code.

3) Work shall include all testing equipment.

PART 2. EQUIPMENT

2.1 CLEANOUTS

A. Cleanouts shall be per plumbing fixture schedule, or per Division 22 section "Sanitary Waste Piping Specialties" and section "Storm Drainage Piping Specialties".

2.2 DRAINS

A. Drains shall be per plumbing fixture schedule, or per Division 22 section "Sanitary Waste Piping Specialties" and section "Storm Drainage Piping Specialties".

2.3 FLASHING

A. Contractor shall flash around each vent pipe extending through roof, with 6 lbs. sheet lead. Flashing shall be installed 10 inches in all directions from pipe underneath roofing material and joined with wiped joint to piece of 6 lb. lead soil pipe, carried up, over and turned down into the top of pipe so as to form a permanent watertight joint, and to permit expansion.

B. All lead flashing shall be entirely painted with a good coat of black Asphaltum before installation.

C. Coordinate installation with roofing contractor.

2.4 LEAD SAFE PANS

A. Contractor shall furnish and install for all roof drains, and all clean-out covers and floor drains in floors above grade a 36"x36" 6 lb. sheet lead pan. All surfaces of pans shall be painted with a good coat of black Asphaltum before installation. Lead safe pans shall be watertight.

B. Coordinate roof drain installation with roofing contractor.

2.5 PLUMBING SPECIALTIES

A. Refer to the on-drawing plumbing fixture schedule which govern for models, or where not shown, refer to specifications below.

B. All plumbing specialties shall be furnished and installed per manufacturer's requirements. All work and material required to rough-in, connect-up and install specialties items shall be provided as required for proper operation. Items are specified by manufacturer's numbers as to the type and quality required.

C. Provide fixtures as indicated in the on-drawing plumbing fixture schedule or herein.

D. TP-Trap Primer: Sloan No. F-72-A1 trap primer assembly, installed in conjunction with Royal No. 113-3 flush valve, with 3/8" tubing and fittings to wall connection. Contractor to provide and install piping between wall fitting and drain trap.

E. GPR-Gas Pressure Regulators: Pressure regulating valves shall be of size and capacities indicated on the drawings. Pressure regulators shall be provided with full flow relief vented outside of the building. Gas pressure regulators shall be provided with inlet and outlet pressure gauges. Regulators shall be Rockwell, Fisher, or approved equal.

F. PRV Water Pressure Reducing Valves: Pressure reducing valves shall be factory set for required pressure and shall be provided with stainless steel or nickel alloy renewable seats, stainless steel

strainer screens, high temperature diaphragms, and shall be rated at a minimum of 250 psig-wwp.

G. Flexible Connections: Flexonics Series 400, or approved equal, braided flexible hose with screwed ends, seamless stainless steel bellows and stainless steel woven braid. Hose shall be of the length and pressure ratings, etc., as required for services and conditions encountered.

H. Thermal Expansion Absorber Tank: Amtrol Model AST Extrol or approved equal for potable water heaters, shall be of the positive fixed diaphragm type, factory pre-charged and field adjustable, with heavy duty Butyl diaphragm rigid polypropylene liner, and rust resistant baked epoxy finish outer shell, complete with NPT system connection and stainless steel air charge valve to facilitate on-site charging. Size and capacity as indicated on the drawings.

1) Tank shall be installed on the cold water side of the water heater, connected between heater and backflow preventer, and charged with air pressure as required by the system operating pressure. Tank shall be ASME constructed and rated for not less than 125 psi working pressure and 200 degree working temperature.

2.6 PLUMBING FIXTURES

A. Furnish plumbing fixtures as indicated on the on-drawing plumbing fixture schedule.

B. All plumbing fixtures, equipment and related accessories shall be furnished and installed in a neat, finished and uniform manner. All work and material required to rough-in, connect up and install supply, drain, waste, soil and vent piping shall be provided as required for proper operation. This shall include plumbing fixtures, equipment and accessories and includes items furnished under other sections or furnished by the Owner. Fixtures, equipment and accessories are specified by manufacturer's numbers as to the type and quality required. (NOTE: The architect may reject any fixture, equipment item or accessory which, in his opinion is not of the quality or type specified.). Specified manufacturers and approved equal manufacturers are as follows.

C. All vitreous china and enameled cast iron fixtures shall be white in color, acid resisting, without blemishes and the best of their respective kind.

D. All stainless steel fixtures shall be 18 gauge, type 302 (18-8) nickel bearing stainless steel, with brushed satin finish and sound deadening undercoat.

E. Plumbing trim utilized shall be provided with renewable seats and replaceable internal working components.

F. Each water closet shall be provided with a seat, seats shall be white, elongated open front, with combination self-sustaining check hinges.

G. Unless otherwise specified, each lavatory shall be provided with: McGuire LFBV02 quarter-turn angle stops and M65 3/8" x 12"(min) flexible risers; McGuire 8902 adjustable, semi cast brass P-trap (1¼" inlet, 1½" outlet) with ground swivel joint, cleanout plug, slip inlet and 17 gauge 1½" trap arm. Provide McGuire 158WC loose key straight stop supplies for wheelchair lavatories.

H. Unless otherwise specified, each sink shall be provided with: McGuire LFBV02 quarter-turn angle stops and M66 3/8" x 15"(min) flexible risers; McGuire 151 basket strainer, 1½" x 4" 17 gauge tailpiece with brass locking and coupling nuts, McGuire 8912 adjustable, semi cast brass P-trap (1½") with ground swivel joint, cleanout plug, slip inlet and 17 gauge 1½" trap arm. Provide additional strainers, tailpieces and continuous waste pieces for multiple compartment sinks as required.

I. All fixtures shall be substantially supported in an approved manner. Furnish and install adjustable carriers with legs, floor bases, bearing plates, support arms or rods as required for all wall hung fixtures. Anchor carriers to floor and brace to wall construction for substantial support. Carriers shall be required to fit fixtures furnished. Verify available space for carriers and provide appropriate carrier to fit space and building construction. Install all supports before walls are finished. The Contractor shall be responsible for a period of one year following final acceptance of the building, for the loosening of any plumbing fixture and any subsequent damage to the building caused by the fixture or as a result of leaks in piping, and shall promptly make repairs to the building, shall replace or repair fixture carriers as deemed necessary by the Architect at no additional cost to the contract.

J. All fixtures shall be set true and level. Install all fixtures in accordance with manufacturer's requirements and at recommended heights unless otherwise indicated.

K. Fixtures that are wall hung or butt a wall shall have adjacent edges and surfaces factory ground true and square.

L. All spaces between fixtures and finished surfaces shall be caulked and pointed square with an approved white silicone sealant resulting in a neat and smooth appearance.

M. All exposed fixture trim shall be polished chrome plated brass.

N. The contractor shall be responsible for the protection and cleanliness of all fixtures, equipment and accessories.

O. Set all countertop fixtures with caulking compound and seal edge of rim with an approved white silicone sealant for a neat, smooth appearance.

P. All precast receptors and basins shall be of standard color and set level in a bed of cement mortar per manufacturers requirements.

Q. All water supply fittings shall close with pressure and have model trim.

R. Refer to the on-drawing plumbing fixture schedule for models, accessories, etc. They govern for bidding.

S. The following fixture and equipment list specifies the basic fixture or item, each of which shall be provided with applicable accessories for its proper operation.

1) Refer to on-drawing fixture schedule.

PART 3. EXECUTION

3.1 FIXTURE BRANCH PIPING

A. Size piping as indicated on drawings and diagrams but not smaller than indicated in the "Branch Fixture Schedule" below.

1. Connection to individual plumbing fixtures shall be as follows:

Item	Waste	Vent	Cold	Hot
Urinal	2″	1 ½″	1″	--
Water Closet	4″	2″	1 ¼″	--
Lavatory	2″	1 ¼″	½″	½″
Drinking Fountain	2″	1 ¼″	½″	--
Janitor Basin	3″	1 ½″	½″	½″
Shower	2″	1 ½″	½″	½″
Sink	2″	1 ½″	½″	½″

B. Provide air chambers at all locations where supply pipes terminate. All air chambers shall be full size of supply piping and 15" long except for flush valves shall be 18" long.

C. All exposed connections and fittings shall be chrome plated brass. All supplies, stops, escutcheons, tailpieces, traps and trap arms within cabinets shall be considered exposed.

D. Provide chrome plated cast brass set-screw escutcheons for all exposed fixture supply and waste piping.

E. All fixture supply and waste piping through wall shall be rigidly supported. Supports in contact with copper piping shall be copper plated or fire retardant plastic.

3.2 SHOCK ABSORBERS

A. Shock absorbers: Furnish and install sealed bellows shock absorbers in the water supply to each bank of plumbing fixtures in main toilet rooms as shown on drawings and in make-up water connections where solenoid valves are installed as shown on drawings. Shock absorbers shall be sized and rated for number of fixtures in each bank in accordance with the Plumbing and Drainage Institute (PDI) Standard PDI-WH201.

B. Manufacturers:

1) Wade: Wade Series W "Shokstop”
2) Zurn
3) Josam

END OF SECTION

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Provide items, articles, materials, operation and methods required by drawings and specifications including labor, equipment, supplies and incidentals necessary for completion of work in Division 23 – Heating Ventilating and Air Conditioning.

B. Design Engineer, hereinafter abbreviated D/E shall mean the Engineering firm, Olsson Associates, 1251 NW Briarcliff, Kansas City, MO, Telephone (816) 361-1177. Contact person: Nick Lynch.

1.2 RELATED DOCUMENTS

A. The General Provisions described herein, together with the conditions of contract, and the General Requirements of Division 1, apply to the work in Division 23 – Heating Ventilating and Air Conditioning.

B. This Section is hereby made a part of all other sections of Division 23 – Heating Ventilating and Air Conditioning, as if repeated in each.

1.3 QUALITY ASSURANCE

A. All permits and licenses that are required by governing authorities for the performance of shall be procured and paid for by the Contractor.

B. All work shall be performed in compliance with all applicable and governing safety regulations including the regulations of the Occupational and Safety Health Act. All safety lights, signs and guards required for performance of work shall be provided by the Contractor.

C. All work shall conform to the requirements of all applicable codes, ordinances and regulations including the rules and regulations of the National Electrical Code, the National Fire Protection Association, the International Mechanical Code, OSHA and all State and Local laws, codes and ordinances.

D. Laws, codes, ordinances and regulations shall take precedent excepting only where the work called for by the drawings and specifications exceeds by quality and quantity.

E. Fixtures, appliances, equipment and materials which are subject to Underwriter's Laboratory tests shall bear such approval.

F. Mechanical and electrical designs are based on the requirements for the specified manufacturers listed on the equipment schedules. Conduit, disconnects, motor starters, breakers, fuses and wire sizes are selected on basis of scheduled equipment. Increased current requirements necessitating larger wire, breakers, switches, etc., to accommodate any alternate or substitute manufacturer's equipment, other than as shown on drawings shall be provided without any increase in contract price by contractor furnishing the equipment.

G. Manufacturers, where specifically called for, must provide factory tests, unit installation observations, unit start-up and tests, etc., as specified, and submit signed reports to the Engineer upon completion of these services. Subletting of these services will not be permitted. Shop drawing submittals shall be accompanied with a letter of certification by the manufacturer that the specified services shall be provided. Failure to do so shall be cause to reject the shop drawing submittals.

H. The contract drawings are in part schematic and intended to convey the scope of work and indicate the general layout, design and arrangement. The Contractor shall follow these drawings in the layout of his work and shall consult general construction drawings, electrical drawings and all other drawings for this project, and shall verify all existing site conditions to determine all conditions affecting the work shown or specified. The contract drawings are not to be scaled and the Contractor shall verify spaces in which the work is to be installed.

I. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Engineer shall be notified before proceeding with installation.

J. Work in cooperation with one another to fit piping and ductwork into the structure as job conditions may demand. All final decision as to right of way and run of pipe, ducts, etc. to be made by Engineer or his representative.

K. All work shall be performed by trained mechanics of a particular trade involved and done in neat and workmanlike manner as approved by "Engineer".

1) Work shall be performed in cooperation with other trades and scheduled to allow timely and efficient completion of project.

2) Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for work, and also furnish information and shop drawings necessary to permit other trades affected to install their work properly without delay.

3) Where there is evidence that work of one trade will interfere with work of other trades, all trades shall assist in working out space conditions to make satisfactory adjustments.

L. Work installed before coordinating with other trades causing interference with work of such other trades shall be changed to correct such condition without increase in contract price and as directed by Engineer.

M. Where specific details and dimensions are not shown on the drawings, the Contractor shall take measurements and make layouts for the proper installation of the work and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications, it shall be assumed, by the signing of the Contract, that the higher cost (if any difference in costs) is included in the contract price, and the Contractor shall perform the work in accordance with the drawings or with the specifications, as determined and approved by the Engineer.

N. The Contractor shall be responsible for a scheduled sequence in performing the work so that it will not interfere with the Owner's operation in the existing building. Before any work is started, the Contractor shall consult with the Engineer and Owner and arrange a satisfactory schedule.

1) Make temporary alterations as required to execute work so that all operations and services in the existing building are maintained with the minimum possible interruption.

2) Temporary shut-downs shall be segregated and shall be of the shortest possible duration. All facilities shall be kept in continuous operation unless specific permission to the contrary is granted by Owner.

O. Definitions:

1) "Piping" includes, in addition to pipe, all fittings, valves, sleeves, hangers, and other supports and accessories related to such piping.

2) "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, or in crawl spaces.

3) "Exposed" means not installed underground or "concealed" as defined above.

4) The words "furnish and install", "provide", "furnish", "install", or equivalent words are used or are understood, to mean the Contractor shall furnish and completely install the system, service, equipment, or material named, together with other associated devices, equipment, material, wiring, piping, etc. as required for a complete operating installation, and conforming to the manufacturer's standards and recommendations.

5) It is the intent of these specifications and drawings to call for finished work, tested and ready for operation.

6) All apparatus, appliances, materials or work not shown on drawings, but mentioned in specifications, or vice versa, and/or all incidental accessories necessary to make work complete and ready for operation, even though not specified or shown on drawings, shall be furnished and installed without increase in contract price.

7) Should there be discrepancies or questions of intent, refer matter to Engineer in writing for decision before ordering any equipment or materials or before starting any related work.

1.4 SHOP DRAWINGS AND SAMPLES

A. Shop drawings, project data and samples furnished by the Contractor shall illustrate materials, equipment or workmanship, and establish standards by which the work will be judged.

B. Shop Drawings and Samples shall be submitted to the Engineer by a letter of transmittal. The party making the submission shall be named on Shop Drawing/Sample and also in the letter of transmittal.

C. When Shop Drawing submissions are in the form of loose pages (8½" x 11") they shall be submitted in sets assembled in portfolio binders showing on the covers or first page inside, a complete list of contents. A minimum of 7 sets of each submission are required, however, additional copies may be requested.

D. When Shop Drawing submissions are in the form of portable document format (PDF), they shall be transmitted via email to the contact information provided during the pre-construction conference. Each submittal transmitted in PDF format shall include only one specification section. Multiple specification section submittals combined into one singular PDF file will not be accepted. The cover page of the submittal shall include all necessary information for proper identification of project, submittal, and date, and shall include a blank area, minimum 4-1/4" by 5-1/2" in size, for placement of the engineer's review stamp. The email transmittal and PDF file naming shall be compliant with the following guidelines:

1) Email submittals to be addressed to: TBD, as instructed during pre-construction conference.

2) Email subject line shall include the following information, in order of listed below and separated by dashes:

   (a) "SUBMITTAL"

   (b) Project Number (as listed in titleblock and specifications).

   (c) Specification Section Number

   (d) Specification Title

   (e) "FOR REVIEW"

   (f) Example: "SUBMITTAL-14071.1-230553-HVAC Insulation-FOR REVIEW"

3) The PDF file for the actual submittal shall be compliant with the following guidelines:

   (a) Project Number (as listed in titleblock and specifications).

   (b) Specification Section Number

   (c) Sequence Number (separated from section number by a 'dot'). In the case of a resubmittal, the sequence number shall remain the same as the previously submitted file, and shall be

   (d) Specification Title

   (e) "FOR REVIEW"

   (f) Example: "14071.1-230553.01-HVAC Insulation-FOR REVIEW.pdf".

4) Failure to follow email transmittal or document naming guidelines will result in an automatic rejection of submittal.

E. The Contractor shall review, stamp with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other contractor, all Shop Drawings and Samples required by the Contract Documents or subsequently by the Engineer as modifications. Shop Drawings and Samples shall be properly identified as specified or as the Architect/Engineer may require. At the time of submission, The Contractor shall inform the Architect/Engineer in writing of any deviation in the Shop Drawings or Samples from the requirements of the Contract Documents.

F. Except in the case of brochures, catalogue cuts and the like, shop drawings shall be in the form of a reproducible print(s) (sepia). In every case, the submittal shall consist of one sepia of each shop drawing and two (2) black line prints of the same. Each print shall be made from the original shop drawing tracing. The transparency shall be capable of producing clean, clear black and white prints.

G. Contractor shall stamp each sepia and black line print (shop drawing) the same. He shall also stamp each brochure, sample and the like. Special Note: Every page with project information shall be stamped. In every instance, the document shall be reviewed by the Contractor and shall also be signed by the Contractor indicating that the document has been reviewed, and that it is approved by the Contractor. The submittals will not be reviewed without the Contractor's approval stamp and signature.

H. The Contractor's approval stamp and signature shall signify that the Contractor has checked the submittals. Any submittals which have not been checked shall be returned to the Contractor for checking, approval stamp, signature, and resubmittal for compliance with the contract documents. After review of the submittals they will be returned to the Contractor with one of the following remarks checked:

1)	No Exceptions Taken	SUBJECT TO CONTRACT DOCUMENTS.
2)	Note Corrections	SUBJECT TO CONTRACT DOCUMENTS RESUBMISSION NOT REQUIRED.
3)	Revise and Resubmit	REVISE, RESUBMISSION REQUIRED.
4)	Rejected	NOT APPROVED.

I. Upon receipt of exhibits submitted and marked for resubmittal the Contractor shall cause the marked corrections, and corrections that may be contained in the Architect/Engineer transmittal letter to be made on each submittal. All such corrections shall be circled, numbered, and dated to permit prompt reviewing upon resubmittal to the Architect/Engineer. Upon receipt of each submittal now marked:

J. The Contractor shall cause submittals to be distributed to the respective contractors and suppliers as is necessary for proper performance of work.

K. At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the exhibits submitted from the requirements of the Contract.

L. The Engineer will review exhibits submitted with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Project and with the information given in the Contract. The Engineer's review of a separate item shall not indicate review of an assembly in which the item functions. The Engineer's review is not intended to indicate approval of dimensions or quantities.

M. Contractor shall make any corrections required by the Engineer and shall resubmit the required number of submittals until further resubmittals are no longer required.

N. Engineer's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract unless the Contractor has the Engineer's approval in writing of such deviation at the time of submission and the Owner's Representative has given written notice to the specific deviation; nor shall the Engineer's review relieve the Contractor from responsibility for errors or omissions in the submitted exhibits.

O. No portion of the work requiring a submittal shall be commenced until the Engineer has reviewed the submission. All such portions of the work shall be in accordance with reviewed submittals.

1.5 OPERATION AND MAINTENANCE MANUALS

A. In addition to the requirements specified in Division 1, the Contractor at the project’s completion shall submit a complete system operating and maintenance manual. O&M manual shall be organized into systems and shall contain the manufacturer's complete detailed operating and maintenance instructions with equipment data for each piece of installed equipment furnished under this project. Manual at a minimum shall include the following:

B. Manual shall be composed of typed instructions sheets with large drawing sheets (not reduced) folded in with reinforced margin, shall have a post binder system so that sheets can be easily substituted, and shall have a hard cover.

C. Include in O&M manuals Manufacturers written maintenance instruction for each different piece of equipment provided and installed on this project.

D. Include spare parts list for each major piece of equipment furnished for the project including but not limited to controls, boilers and accessories.

E. Provide a comprehensive list of maintenance procedures for preventative maintenance and troubleshooting; disassembly, repair and reassemble; aligning and adjusting instructions.

PART 2. EQUIPMENT

2.1 GENERAL

A. All materials and equipment shall be new and shall bear manufacturer's name, model number and other identification marking.

B. All materials and equipment shall be standard product of manufacturer regularly engaged in production of required type of material or equipment for at least 5 years (unless specifically exempted by Engineer) and shall be manufacturer's latest design having published properties.

2.2 FIRESTOPPING

A. Firestopping is defined herein as the process of furnishing and installing a material, or combination of materials, in various constructions to maintain an effective barrier against the spread of flame, smoke, and gasses and to retain the integrity of time-rated construction. It shall be used in specific locations as specified hereinafter.

1) Piping penetrations through floor slab and through time-rated partitions of fire walls;

2) Opening between floor slabs and curtain walls, including inside hollow curtain walls at the floor slab;

3) Penetrations of vertical service shafts;

4) Openings and penetrations in enclosures with time-rated fire doors;

5) Other locations where specifically shown on drawings or where specified in other sections of these specifications;

6) Openings in non-time-rated construction shall be closed with a compacted fill of ¾ lb. density fiberglass and then sealed gas tight.

B. Material of firestopping shall be asbestos free and capable of maintaining an effective barrier against flame, smoke and gases in compliance with the requirements of ASTM E 814, UL NO. 1479. Fire-stopping material shall be manufactured by 3M barrier products. Products shall be capable of providing a cold smoke and water seal. When exposed to temperatures exceeding 250ºF these products shall rapidly expand up to ten times the original volume.

C. Installation of fire stopping shall be in accordance with the manufacturer’s recommendations and requirements. Surface to be in contact with firestopping shall be cleaned of dirt, grease, oil, loose materials, rust, or other substance that may affect proper fitting or the required fire resistance.

D. Firestopping materials shall provide an effective barrier regardless of the geometric configurations of the void spaces. Firestopping materials for filling voids in floors having openings of four (4) inches or more shall be installed to support the same load as the floor is designed to support, unless the area is protected by a permanent barrier preventing loading or traffic on the fire-stopped area.

E. At a minimum fire stop systems shall be designed to achieve a 2-hour F rating with an emphasis on also achieving a 2-hour T rating. In addition to fire and thermal protection, fire stop systems shall be designed to provide a barrier to the transmission of smoke and toxic fumes.

F. A firestop system as defined by these specifications shall consist of fire barrier products, in certain configuration and quantity, to meet the intent of the specifications above. Fire protection products include:

1) 3M fire barrier CS-195 composite sheet

2) 3M fire barrier moldable putty

3) 3M fire barrier CP 25WB caulk

4) 3M fire barrier FS-195 wrap/strip

G. Firestop systems for floor and chase penetrations shall be installed on both sides of the penetration (top and bottom) (in and out). Firestop systems shall be symmetrically installed on both sides and shall meet or exceed all requirements for AT&T standard practices.

2.3 ELECTRICAL EQUIPMENT

A. General: Unless specifically specified or shown otherwise, the Contractor shall furnish required motors, variable speed drives with controls, and disconnect switches for equipment furnished under

this Division. Motors, drives, and associated controls, and disconnecting equipment shall be provided where indicated and as required for operation of the equipment being furnished. Motors shall be designed for full voltage starting unless otherwise specified or noted on drawings and shall be suitable for continuous duty at 40 C. ambient. All motors shall be selected, designed and fabricated in conformance with the requirements of NEMA-MG-1 standard.

B. All motors shall be NEMA Design B induction motors with voltage and phase scheduled on drawings. Motors shall be equipped with Class F insulation, rated with a service factor of 1.15 and nominal full-load efficiency within 1.5% of the maximum values provided by the National Electrical Manufacturers Association Standard 12.6C in publication MG 1. The motor efficiency testing standards for all motors is IEEE Standard 112-1984, "Standard Test Procedure for Polyphase Induction Motors and Generators". All motors shall have a 2% - 5% power factor improvement over typical standard efficient motors. Motors shall comply with the frame size assignments of NEMA MG 13-1984. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

C. Rating: Motor rating, service factor and nameplate data shall conform to the requirements of NEMA-MG-1 standards. Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on start-up conditions or at the equipment maximum load point.

D. Nameplate data shall conform to NEMA MG 1 requirements. For motors of one horsepower and greater, the following additional nameplate data shall be included:

1) Manufacturer's identification number

2) Frame size number

3) Insulated system class designation

4) Service factor

5) Locked-rotor KVA code letter

6) Starting limitations (if any)

7) Hazard classification (if approved)

(a) Design and construction of each motor shall be coordinated with the driven equipment requirements.

E. Service factor - All motors of one horsepower and greater shall be furnished with a service factor of 1.15 in accordance with NEMA-MG-1.

F. Enclosures - All motors shall be self-cooled. Motors for indoor service shall have drip-proof enclosures. Motors for outdoor service shall be totally enclosed and shall have all exposed metal surfaces protected, where practical, with a corrosion resistant polyester paint or coating. Exposed unpainted and uncoated metal surfaces shall be of a corrosion resistant material. All self-ventilated open type motors and the fan hoods of totally enclosed fan cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine. Totally enclosed motors shall be furnished with cast iron frames, bearing brackets and terminal housings. Fan cooled motors shall have fans fabricated of corrosion resistant metal and cast iron fan covers.

G. Bearings for fractional horsepower motors shall be designed to operate in any position or angle. One-piece sleeve bearings with wick lubrication shall be furnished where available. Ball bearings shall be furnished where sleeve bearings are not available and where axial thrust loads exceed 20 pounds.

H. Bearings for motors of one horsepower and greater shall be oil lubricated sleeve bearings. If motor frame size is such that sleeve bearings are not available, bearings shall be grease lubricated rolling element type, self-lubricated and re-greaseable.

2.4 DISCONNECT SWITCHES

A. Material - Disconnect switches shall be NEMA type HD (Heavy Duty) quick-make, quick-break disconnect switches not furnished by others with equipment and where indicated on drawings or where required by Code. Switches shall be fusible or non-fusible as called for or as required. Switches shall have NEMA I enclosure unless otherwise specified or called for otherwise on

drawings. Switches shall have door interlock and shall be padlockable in "open" and "closed" position. Where indicated for use in motor circuits utilizing VSDs switch shall be furnished with interlock contacts for interface with VSD, preventing operation of VSD when load is disconnected.

B. Reference E-series drawings and Division 26 for disconnect switches provided by electrical contractor. If not shown and required it is assumed the equipment manufacturer is providing it. If not, the contractor shall be responsible for all providing including all labor for installation.

2.5 MOTOR STARTERS

A. Starters shall be in accordance with NEMA ICS, UL 508 and the following paragraphs:

B. All starters installed indoors shall be in a NEMA 1 enclosure and all starters installed outdoors shall be in a NEMA 4 enclosure. Enclosures shall be designed for surface mounting unless otherwise indicated.

C. Each starter shall have a nameplate on the cover. Nameplates shall be made of laminated black and white plastic with the white on the outside. Lettering shall be bold, not less than 1/4 inch square, engraved through the white outside layer so that the letters appear black. Nameplate wording will be furnished as called for on drawings or as approved by the Owners Representative.

D. Magnetic starters shall include 480 volt, 3-phase, 60 hertz contractors with three manual reset thermal overload relays, 120 volt operating coils, and 480 to 120 volt dry type control transformers complete with one secondary lead fused and the other secondary lead grounded. Large size starters which require line voltage to energize the operating coils shall be equipped with auxiliary contractors for use in the operating coil circuit. These contractors shall be operated from the 120 volt circuit of the control transformers. Reduced voltage starters shall be closed transition auto transformer type equipped with taps for 50, 65 and 80 percent of full voltage. Two speed starters and reversing starters, shall be mechanically and electrically interlocked so that only one set of contacts can be closed at any one time. Contractors shall have a current rating in accordance with NEMA standard ICS.

E. Two each normally open and normally closed interlock contacts shall be furnished with each starter as indicated. Additional interlocks shall be as called for on drawings.

F. Three thermal overload relays of the bimetallic strip or euthenic alloy type shall be furnished with each motor starter. Thermal overload relay heaters shall be sized to protect their associated motors of the circuits from damage due to overload. Provisions shall be made for manually resetting the thermal relay without opening the starter cover.

G. Control Transformers shall have 60 hertz ratings permitting operation at a primary voltage ranging from 208 to 240 volts. Assuming 208 volts on the primary terminals, each control transformer shall maintain a minimum potential of 105 volts at its secondary terminals during starter coil inrush, while simultaneously serving an additional load of 100 volt amperes at 50 percent power factor. Control transformers shall be mounted in the enclosure with the magnetic starter.

H. Each magnetic starter shall be equipped for control from local remote push-button or control switch, or other pilot devices as called for on drawings. All necessary internal wiring for this feature shall be supplied and connected to terminal blocks located to provide easy connection to the external control wiring.

I. A push to test running pilot light shall be provided and mounted in the cover of each magnetic starter to indicate when the motor is in operation. The light shall be of the transformer type with a 6 volt bulb and a red color cap.

J. Hand-Off-Auto" Selector Switch Units shall be provided and mounted in the cover of the starter as indicated in these specifications and as indicated on drawings. Units shall be heavy-duty, oil-tight and shall be complete with contact blocks and legend plates. Momentary contact "start-stop" push-buttons shall be provided with an auxiliary contact for use in the holding circuit.

K. Schematic Diagrams shall be as indicated on drawings or as approved by the Contracting Officer.

L. Each combination starter where indicated on drawings shall include a magnetic starter, as specified hereinbefore, and a disconnect switch or a fusible disconnect switch complete with fuses.

1) Each fusible disconnect switch unit shall include one 3 pole, 600 volt, quick-make, quick-break, manually operated switch connected in series with one replaceable dual element fuse per switch pole. The switch and fuse elements shall be sized according to the following:

Starter Size	Fuse Clip Size
00	30 ampere
0	30 ampere
1	60 ampere
2	60 ampere
3	100 ampere
4	200 ampere
5	400 ampere

M. Fuses shall be UL 198D Class K5, 600 volt, and dual element type. Fuses shall have a thermal element that restricts the temperature rise to 280° F. and an element of low peak type that limits the let through fault current. Fuses shall be rated at 200,000 amperes RMS symmetrical interrupting capacity and shall have a minimum time delay of 10 seconds at 500% of rating as specified hereinbefore.

N. A manual operating handle shall be mounted in the cover of each starter to operate the disconnect switch. The handle shall have provisions to lock in the open position with one or more padlocks. The cover and switch shall be interlocked so that the cover cannot be opened normally when the switch is in the closed position. Provisions shall be made for overriding this interlock.

O. Motor starters shall be wall or column mounted not more than six feet above the floor or mounted on the equipment if readily accessible from the floor or roof. Each starter shall be labeled on the cover as specified hereinbefore. The labeling shall be done with black letters on a white background. Letters are to be 1/4 inch high.

P. Nameplates - All major equipment items shall have a permanent stainless steel nameplate. Nameplates shall include the applicable items in the following list:

1) Manufacturer's size and type
2) Serial number
3) Design capacity
4) Design pressure
5) Design speed
6) Design temperature
7) Design static pressure "w.c.”
8) Motor horsepower and RPM

Q. A permanently attached rotation arrow shall be provided on all items of rotating equipment.

PART 3. EXECUTION

3.1 CUTTING AND PATCHING

A. The responsibility for any cutting of construction, which is required for the installation work, shall be by the Contractor. The Contractor shall coordinate with the Owner before any cutting and obtain approval from the Engineer and the Owner prior to any cutting.

B. Where openings for work within this Division are provided under other sections of the specifications, this Contractor shall be responsible for locating and providing the proper dimensions for all such openings.

C. Cutting shall be done with extreme care and in such a manner that the strength of the structure will not be endangered. Wherever possible, openings in concrete or masonry construction shall be by concrete saw or rotary core drill. Openings in any construction shall be cut the minimum size required for the installation of the work.

1) Adequate protection shall be provided to prevent damage to adjacent areas and to prevent dust from spreading to adjacent areas.
2) The use of jackhammers will not be permitted.

D. Where openings or holes are cut in existing construction and the cutting breaks existing electrical circuitry or control circuitry, or communications, conduit and wiring, then it shall be the responsibility of the Contractor to have the circuitry, conduit and rewiring re-routed and to complete

the circuitry as required and as approved by the Owner. Temporary completion shall be provided where necessary before the permanent re-routing and completion work is finished. All costs for this work shall be the responsibility of the Contractor and no additions will be allowed to the Contract price.

E. Before any cutting, patching, or finishing work is started, dust and moisture protection shall first be installed as required to protect adjacent construction and equipment and to prevent dust spreading from the immediate area where work is being performed.

F. After any work is installed through any opening in walls, partitions, ceilings, or floors, the opening around the work shall be patched to match the existing construction, and the openings around pipe sleeves, between pipes and sleeves, and around ductwork shall be sealed watertight through floors and shall be sealed fireproof and smoke tight through floors, walls, partitions and ceilings.

G. Where existing work is removed from openings in existing construction and the opening is not to be reused for new work, the opening shall be filled and patched to match existing adjacent construction and to be watertight for floors and to be fireproof and smoke tight for floors and all other construction.

H. No structural member shall be cut without the approval of the Consultant, and all such cutting shall be done in a manner directed by him.

3.2 ELECTRICAL COORDINATION

A. All electrical products and installation used on this project shall conform unless otherwise specifically noted, to applicable standards of the National Electrical Manufacturers Association, NFPA 70, Division 26 of these specifications, and shall also be listed by Underwriter's Laboratories, Inc. and/or other agencies, as required.

B. Electrical power sources and motor connections for all equipment shall be provided as specified within Division 26 of these specifications. All control wiring, safety interlock wiring, and temperature control system wiring required shall be furnished and installed as specified within these specifications. The control wiring shall include the furnishing and installation of all conduit, boxes, fittings, devices, accessories, wire, and connections required for complete and properly functioning systems. All wiring shall be installed in conduit, and all splices and connections shall be made in approved type enclosures or boxes.

1) If motors or controls are not shown on the Electrical Drawings, it has been assumed that these motors and controls have been wired as part of a piece of package equipment, or that control wiring will be run by the Contractor.

C. Reports: The Contractor shall submit to the Engineer, after mechanical systems are completely installed and operating under normal load conditions and prior to final acceptance of the project, four (4) copies of tabulated report on each piece of mechanical equipment motor and motor starter. The tabulated reports shall show the following information:

1) Mechanical equipment identification on which motor and starter is used

2) Motor nameplate horsepower, full load amperes, and voltage

3) Motor nameplate service factor and temperature rise

4) Actual (metered) motor running amperes and voltage

5) Motor starter nameplate: HP rating and voltage

6) Motor starter thermal overload protection unit current rating, manufacturer's name and manufacturer's catalog number marked on thermal units.

3.3 NOISE AND VIBRATION

A. Contractor shall be responsible for the installation of all equipment in such a manner as to control the transmission of noise and vibration from any installed equipment or system, so the sound level shall not exceed NC35, in any occupied space. Contractor shall be responsible for the correction of any objectionable noise in any occupied area due to improperly installed equipment.

3.4 TEMPORARY UTILITIES, SERVICES AND CONNECTIONS

A. The Contractor shall provide temporary electric power for construction purposes in accordance with all Codes and Ordinances and as required by projects. All temporary equipment, materials and connections required for the temporary services shall be furnished and installed by the Contractor. At the completion of the project or at such time as the temporary services are no longer needed, the Contractor shall remove all temporary equipment, materials, and connections and shall restore facilities to permanent finished conditions. Contractor may obtain temporary service from the existing building.

B. Temporary wiring connections and facilities shall be installed as required, so that all spaces, fixtures, devices, equipment, and circuits that are required to stay in operation do so, and so that interruptions in the use of any space, device, fixtures or piece of equipment can be held to the absolute minimum time possible.

C. Interruptions in existing utilities, services, or in the electrical circuitry and facilities shall be scheduled and sequenced as hereinbefore specified in this section of the specifications, and sequencing shall also conform to specific requirements as specified in other sections of the specification or as indicated on the drawings. The scheduling and sequencing shall be coordinated in advance with the Owner and Architect and shall be as approved by these parties. Even though a schedule is approved, the Owner shall also be notified immediately prior to any interruption in any electric facilities and circuits so that alternative arrangements can be made.

3.5 INSPECTION

A. Each bidder shall inspect the site as required for knowledge of existing conditions and failure to obtain such knowledge shall not relieve the successful bidder of the responsibility to meet existing conditions in performing the work under the contract.

B. Where new work cannot be installed without changes in existing plant, facility or systems or where it is indicated on drawings to rework an existing installation, this contract shall include alterations to existing work as required to install new work. Additions to the contract cost will not be allowed because of this Contractor's failure to inspect existing conditions.

C. Where existing power, lighting, or control circuitry is broken by removal of existing devices, equipment, or fixtures, or by demolition work, cutting or removal of existing building construction, and where the existing circuitry is required by remaining devices or equipment to stay in service, then the circuitry shall be completed as required by job conditions.

D. Existing conditions indicated on the drawings are taken from the best information available on previous contract drawings and from visual site inspection and are not to be construed as "As-Built" conditions, but are to indicate the intent of this work. It shall be the responsibility of the Contractor to verify all existing conditions at the project site and to perform the work as required to meet the existing conditions and the intent of this work indicated.

3.6 TESTING

A. All electrical equipment furnished under this Division shall be adjusted and tested by this Contractor. Motors and other equipment furnished by others, to which electrical connections are made under this Division, shall be checked for short circuit and open circuits before energizing. Motors shall be checked for proper phasing and rotation. The thermal overload protection devices shall be checked in all motor starters, and equipment and all protection device size, motor nameplate full load amperage, and voltage rating for protection of the motor shall be listed (include equipment designation, rating of heater, motor nameplate horsepower, full load amps and voltage) and 4 copies of list shall be submitted to the Architect.

B. Mechanism of all electrical equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required. Adjustable parts of all lighting fixtures and electrical equipment shall be checked, tested and adjusted as required to produce the intended performance.

C. Completed wiring systems shall be free from short circuits and after completion, perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

D. The Contractor shall be held responsible for the operation, service and maintenance of electrical equipment during construction and prior to acceptance by the Owner. All electrical equipment shall be maintained in the best operating condition. Operational failure caused by defective material

an/or labor furnished under this Division shall be immediately corrected. Architect shall be immediately notified of any operational failures caused by defective material and/or labor covered under other Divisions or furnished by others.

3.7 START-UP

A. All labor for the installation of material and equipment furnished under this Division shall be done by experienced mechanics of the proper trade and all workmanship shall be first class and in compliance with the specific requirements of drawings and specifications.

B. All material and equipment provided under this Division shall be installed under competent supervisory service furnished by the Contractor. Where necessary, this shall include the services of special erection and operation personnel.

C. The Contractor shall furnish all hoists, scaffolds, staging, runways, tools, machinery and equipment required for the performance of work.

D. Dirt and refuse resulting from the performance of the work shall be removed from the premises daily as required (broom clean) to prevent accumulation and the Contractor shall cooperate in the maintaining of reasonably clean premises at all times.

E. Immediately prior to the final inspection, Contractor shall clean all material and equipment. Dirt, refuse and stains shall be removed from all surfaces and damaged finishes restored to original condition.

3.8 TRAINING

A. The Contractor shall furnish all services as required for adequate verbal and printed instructions to the Owner and the Owner's operating and maintenance personnel for operation and maintenance of all equipment and systems installed under this Division. Three complete copies of service manuals in hardback binder shall be furnished at the end of the project in accordance with the General Conditions of the specifications. The manuals shall include printed operating and maintenance instructions for systems and equipment specified under this Division, all approved shop drawings and all manufacturer printed data.

B. When the work is complete and at a time designated by the Owner's designated Representative, the Contractor shall furnish the services of a qualified instructor to instruct the Owner's personnel in the operation and maintenance of the systems and equipment.

C. The bound copies of the operating and maintenance manuals shall be used during the verbal instructions.

END OF SECTION

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SECTION 23 05 01 - MECHANICAL PROJECT COORDINATION AND INSTALLATION

PART 1. GENERAL

1.1 CONTRACTOR'S USE OF PREMISES

A. Confine operations at site to areas and limits permitted by law, ordinances, permits; Contract Documents and GENERAL CONDITIONS.

B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.

C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with Work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

D. Contractor shall pay for, or satisfactorily repair, all damages incident to their Work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this Contract.

1.2 HAZARDOUS MATERIALS

A. Submit Material Safety Data Sheets for all materials furnished in this project defined as hazardous by NFPA. All requirements of the Material Safety Data Sheets shall be implemented and followed judiciously when hazardous materials are installed or otherwise used.

B. All hazardous materials shall be stored and used (mixed, applied, etc.) in strict accordance with the OSHA Standards, Safety Data Sheets and the Owner's Safety standards.

C. Refrigerants, nitrogen, welding gas, paints, varnish, volatile oils, etc., shall be stored in a room having good ventilation and containing no other material, or in metal lockers or barrels well away from structures or other combustible materials.

1.3 WELDING AND CUTTING

A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations. Before proceeding with any electric or gas welding or cutting or soldering work in or adjacent to the existing building the Contractor shall obtain a permit from either the Engineer or Owner. The permit shall be issued by its authorized supervisor or representative certifying compliance with conditions set out in the permit pertaining to welding and cutting operations.

END OF SECTION

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SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Piping Hangers and Supports

B. Duct Hangers and Supports

C. Roof Mounted Curbs and Equipment Supports

PART 2. EQUIPMENT

2.1 PIPING HANGERS AND SUPPORTS

A. Provide factory-fabricated horizontal piping hangers, clamps, attachments and supports in compliance with ANSI SP-69 and ANSI SP- 89. Select hangers and supports sized to exactly fit pipe size for bare piping, and to exactly fit around pipe insulation with saddle and shield for insulated piping. Hangers in contact with copper pipe shall be copper plated.

B. Unless specified otherwise, pipes shall be hung with malleable iron, split ring hangers or clevis hangers not less than 1/8" thick. Strap type hangers shall not be acceptable. Roller type hangers shall be used where required or shown to allow for movement of pipes by expansion. Hangers shall have rods and turnbuckles of required length. Suspension shall be from suitable steel supports fastened to overhead construction or steel wall brackets. Hangers and supports shall be installed so that pipes are run parallel and evenly spaced.

C. Anchors in concrete construction shall be threaded compound type or Phillips self-drilling type of sufficient size to adequately support the load.

D. Manufacturer:

1) Hangers and supports:

(a) Mason Mfg. Co.
(b) Kindorf Mfg.
(c) Unistrut Mfg., Inc.
(d) Fee Mfg.

2) Saddles and shields:

(a) Pipe Shields, Inc.

2.2 DUCT HANGERS AND SUPPORTS

A. Material - Duct hangers shall be galvanized steel band iron or 1¼" x 3/16" angle and 3/8" rods. Wall supports for ductwork shall be galvanized steel band iron or fabricated angle bracket. Support vertical ductwork at floor with rolled 1¼" x 3/16" structural steel angle.

B. Duct Supports: Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts straight, plumb, free of sags and vibration, and to prevent buckling. Support ductwork from building structure where not otherwise indicated, anchor with bolts, concrete inserts, welded studs, C-clamps, or special beam clamps with support as indicated in the SMACNA Standards. Anchor methods other than listed shall receive prior approval from Owner before using. Support vertical ducts, at every floor, 12 foot maximum spacing, by attachment to adjacent vertical structural surfaces or by direct bearing at floor penetrations and similar locations.

2.3 ROOF MOUNTED CURBS AND EQUIPMENT SUPPORTS

A. Unless noted otherwise, contractor shall be responsible for providing curbs and supports for all equipment to be installed on roof. Contractor shall coordinate equipment specifications and locations with each piece of equipment to ensure equipment is properly supported.

B. Curbs and equipment supports for roof mounted equipment shall be of monolithic construction, not less than 18 ga. galvanized steel, with continuous welded corner seams, factory installed wood nailer, built-in raised cant of height as required for thickness of roof insulation, and base as required for attaching to the roof structure.

C. Curbs shall be internally insulated with 1½" thick, 3 lb. density rigid glass fiber board and shall have galvanized sheet metal liner. Equipment supports shall have integral base plate, wood nailer, and 18 gauge galvanized steel flashing cap.

D. Curbs and equipment supports shall be of size as required to properly mate with equipment to be mounted on the curbs or supports and shall be designed and constructed to safely support the weight of the equipment. The height of curbs shall be as indicated on drawings, but not less than 13½" high above the roof deck, unless called for or specified otherwise.

E. The curbs and supports shall be securely attached to the roof structure to withstand wind pressures on the vertical surface of the curb or supports and the mounted equipment by wind velocities up to 100 MPH. The complete installation shall be made watertight and shall be coordinated with the roofing installer.

F. Curbs which serve grease laden applications shall be ventilated and uninsulated. Coordinate with tenant infill plans for quantity and location of applicable equipment.

G. Manufacturers:

1) Roof Curbs
   (a) Pate Manufacturing Company: PC-2
   (b) Thycurb
   (c) Custom Curb

2) Equipment Supports
   (a) Pate Manufacturing Company: ES-5A
   (b) Thycurb
   (c) Custom Curb

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Comply with MSS SP-69 and SP-89 for installation of hangers, supports and anchors. Install hangers, supports, clamps, and attachments directly from building structure complete with inserts, bolts, rods, nuts and washers, and washers, and accessories. Do not use wire or perforated metal to support piping; pipe support from other piping shall not be permitted. Install hangers with minimum ½" clear space between finished covering and adjacent work. Place hanger within 1 foot of each horizontal elbow. Use hangers vertically adjustable 1½" minimum after piping is erected.

B. Insulated pipe, hangers and supports shall be furnished with ribbed galvanized steel shields of not less than 18 gauge; two-piece pre-molded, high compressive strength, insulation inserts (360° around pipe); and vapor barrier jacket covering the insulation inserts. Inserts shall be constructed of high density, 100 psi, waterproofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

C. Maximum spacing of hangers and supports shall be in accordance with the following schedule for size of pipe:

Pipe Size	Rod Size	Ferrous Pipe	Copper Pipe	Plastic Pipe
½" & ¾"	¼"	8'-0"	6'-0"	4'-0"
1" & 1¼"	3/8"	9'-0"	7'-0"	4'-6"
1½"	3/8"	9'-0"	8'-0"	5'-0"
2" & 2½"	3/8"	10'-0"	9'-0"	5'-0"
3" & 4"	5/8"	10'-0"	10'-0"	6'-0"
6" to 12"	7/8"	14'-0"	7'-0"	
14" to 18"	1"	20'-0"		

D. Hangers for cast iron pipe shall be installed on maximum 5'-0" centers.

E. Supports on masonry walls shall have bolts through wall fastened to suitable steel plate on back of wall. Where required to allow for movement of pipe by expansion due to short hanger rods, pipes shall rest on rollers and covering protection saddles. All piping shall be supported and secured as required to prevent vibration and the transmission of noise and lateral movement.

F. The Contractor shall furnish and install all necessary material, hangers and support including all structural steel members and shapes to substantially support and/or suspend all piping and equipment, in an approved manner. Perforated strap hangers will not be acceptable.

1) Drive screws, pins, studs, etc., which are secured in place by means of explosive force will not be permitted.

2) Except as specifically otherwise approved, no item of equipment shall support any pipe or duct nor shall any item of equipment be supported on any pipe or duct.

G. Hangers shall be provided at every item of equipment and at every change in direction or branch connection to every pipe.

H. All pipes through roof shall be installed with sleeves and openings, and with roof flashing/counterflash assembly or pipe curb assembly as herein specified. The complete installation shall be coordinated with the roofing installer and shall be watertight and weather tight.

I. Sleeves shall be steel pipe and shall be installed for single pipe installation. Openings shall be boxed out for multiple installations. Sleeves for acid waste vent stacks shall be installed as specified under the heading: Sleeves and Openings.

J. Single, un-insulated pipes through roof shall be installed with flashing/counterflashing assembly with four pound seamless lead flashing assembly with 8" high boot and not less than 8" skirt. A conical shaped steel reinforcing boot underneath lead flashing assembly shall also be installed. Cast iron counterflashing fitting with rust-resistant prime coat, of the caulking type to fit over all types of piping, vandal-proof set-screws for anchoring in place, and top annular space for sealant fill shall also be installed for single, un-insulated pipes. Assemblies shall be furnished in sizes to properly fit size of pipe with which they are installed. Flashing assembly shall be designed to fit properly on roofs from level up to 20° pitch. Top of flashing cone shall be sealed before installing counterflash fitting. Annular space in top of counterflash fitting shall be completely filled with epoxy sealing compound.

K. Grouped multiple pipes through roof and insulated pipes through roof shall be installed with factory prefabricated metal curb assembly of unitized construction of not less than 18 ga. galvanized steel with base plate for anchoring to roof deck or roof slab. The cant base for roof insulation thickness shall match the thickness of insulation where it is to be installed. A wood nailer strip shall be installed on top of the curb, and shall have 1½" thickness of 3 lb. density fiberglass insulation on inside, and not less than 11" high from base to top of wood nailer. The curb assembly shall also have an acrylic clad ABS plastic flashing cover with number and size of formed openings as required for the number and size pipes through roof, along with a graduated step neoprene boot for each pipe. A neoprene boot shall be secured around pipe and around formed opening in flashing cover with stainless steel clamps for waterproof connections. Insulation on insulated pipes shall be continuous through the curb, flashing cover, and the neoprene boot. After roofing is flashed up over the curb and secured in place, the ABS plastic flashing cover shall be installed over curb and flash roofing and anchored in place for a watertight and weather tight installation.

L. Furnish and set all boxouts for openings and all sleeves for work to be installed under this division. Sleeves shall be installed for all pipes passing through floors, walls, and partitions. All sleeves shall be set tight in construction, without space between the sleeve and construction. Sleeves through walls and partitions shall be flush at each end and sleeves through floor shall extend 2" above finished floor unless indicated otherwise.

M. Sleeves through concrete slabs, concrete walls, and bearing masonry walls shall be steel pipe of not less than Schedule 30. Sleeves through non-bearing wall and partitions may be Schedule 10 pipe or 22 ga. sheet steel with formed bead on each end.

N. The annular space around bare pipes and pipe insulation on insulated pipes through sleeves shall be packed tightly with mineral wool to prevent transmission of air and sound. Each end of sleeve at floors and through fire-rated walls shall also be sealed with 1" thickness of waterproof and fireproof caulk equivalent to 3M #CP25 fireproofing caulk.

O. Sleeves for round and rectangular ducts shall be galvanized steel. Sleeves through fire and smoke walls shall comply with NFPA 90A. Size sleeves to allow for expansion movement and to provide for continuous insulation.

P. Duct Hangers and Supports Installation

1) Provide and install duct hangers and supports as indicated on the following schedule:

2) Low velocity ducts hanger minimum sizes:
   (a) Up to 30" wide: 1¼" x 3/16" angle at 10 feet spacing
   (b) 31" to 48" wide: 1½" x 3/16" angle at 10 feet spacing
   (c) Over 48" wide: 1½" x 3/16" angle at 8 feet spacing
3) Horizontal duct on wall supports minimum sizes:
   (a) Up to 18" wide: 1½" x 16 gauge or 1" x 1" x 1/8" at 8 feet spacing
   (b) 19" to 40" wide: 1½" x 1½" x 1/8" at 4 feet spacing

Q. Assemble and install ductwork in accordance with SMACNA standards, in a manner which will achieve air-tight and noiseless systems, capable of performing each indicated service. Align ductwork accurately at connections. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts straight, plumb and free of sags and vibration. Ducts shall be supported with steel rods of not less than 3/8" diameter or not less than 1" wide, 16 gauge galvanized steel straps.

R. Support ductwork from building structure where not otherwise indicated, anchor with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps, or special beam clamps. Supporting ductwork from piping, electrical equipment or cable trays will not be permitted.

S. Arrange hangers, supports and duct resets to permit free, unrestrained and noiseless expansion and contraction of duct. Vertical members may be fastened to duct sides with sheet metal screws. Seals all screw attachments to ductwork with mastic and seal gas tight.

T. Each Contractor shall provide all structural steel and materials necessary to properly support and anchor equipment and lines provided under this contract.

U. All equipment and materials shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and suitable for the service required.

V. Concrete bases shall be provided where shown on the drawings. Equipment which is to be grouted in place shall be grouted with Embeco or approved non-shrink grout.

END OF SECTION

SECTION 23 05 48 - HVAC VIBRATION ISOLATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Vibration isolators

1.2 QUALITY ASSURANCE

A. All vibration isolation of rotating and reciprocating mechanical equipment and piping systems furnished under this contract, unless specified otherwise, shall be the complete responsibility of a vibration isolation manufacturer. All isolation equipment shall be of the same manufacturer and the selection of the proper isolators, including number and locations, shall be the responsibility of this manufacturer.

B. The isolation manufacturer shall determine the weight of equipment, distribution of weight and location as well as type and size of isolators required to provide uniform deflection. Manufacturer shall furnish all rails, steel framing members, isolators and all accessories necessary to provide complete installations. Due consideration shall be given to building resonance, floor spans, floor deflection and proximity of equipment to occupied areas when making isolator selections.

C. The isolation manufacturer shall coordinate his selections with the exact equipment that is actually to be furnished for installation and shall be completely responsible for satisfactory vibration and noise control throughout the installation.

D. The isolation manufacturer shall provide adequate installation information without delay to insure that proper provisions are made for the installation of isolators and avoid conflicts during construction.

1.3 SUBMITTALS

A. Submit in accordance with General Requirements, Division 1, Section 013300.

B. Submittals required:

1) Furnish shop drawings to include manufacturer's model number for each isolator to be furnished, number and location of isolators to be furnished for each machine or pipeline, free height, deflected height, and loading for neoprene or fiberglass isolators, and dimensional and weight data for steel rail bases together with method of attachment of isolators to bases.

2) Vibration isolation shop drawings shall show isolator locations, load on each isolator, and shall also include installation instructions.

PART 2. EXECUTION

2.1 VIBRATION ISOLATORS

A. Material

1) All spring type isolators shall be capable of 30 percent over travel before becoming solid.

2) Centrifugal exhaust fans located on the roof shall be installed with free standing spring type housed isolators with not less than 1/4" thick neoprene acoustical friction pads on the bottom of the isolators.

B. Manufacturer

1) Consolidated Kinetics Corp.
2) Korfund Dynamics Corp.

2.2 PAD TYPE ISOLATORS

A. General: Provide pad type isolators in thicknesses and shapes required for use in vibration isolation units.

B. Neoprene Pads: Oil-resistant neoprene, standard hardness, cross-ribbed or waffled pattern.

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Comply with manufacturer's instructions for installation and load application to vibration isolation materials and units.

B. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for any temporary protection against overloading during installation. Anchor and attach units to substrata and equipment as required for secure operation and to prevent displacement by normal forces. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units where leveling devices cannot be used to distribute loading properly.

C. Isolation requirements:

1) Isolation shall be stable during starting and stopping of equipment without any transverse and eccentric movement of equipment that would damage or adversely affect the equipment or attachments.

2) The installed vibration isolation system for each floor or ceiling mounted item of equipment shall have a maximum lateral motion under equipment start up and shut down conditions of 1/4". Motions in excess shall be restrained by approved spring type mountings.

3) All electrical connections, drain connections, piping connections, etc. made to equipment which rests on vibration isolators, shall be sufficiently flexible to permit the equipment to be properly isolated. Care shall be taken so that the equipment isolation is not "short-circuited" by connection to the equipment or attachments to the equipment.

4) Isolation shall be selected for the lowest operating speed of equipment.

5) Isolators, including springs, exposed to weather shall be hot dipped galvanized after fabrication. The hot dipped zinc coating shall be not less than two ounce per square foot by weight complying with ASTM A-123.

6) Isolators shall be selected and located to produce uniform loading and deflection even when equipment weight is not evenly distributed. Special foundation suspension systems shall be furnished for equipment having a large unbalance in the horizontal direction. Isolators for special bases shall have equipment manufacturer's approval.

7) Isolators for equipment mounted on roof or other outdoor installations shall be furnished with vertical stops as required to limit displacement caused by wind conditions.

3.2 PERFORMANCE OF ISOLATORS

A. General: Provide vibration isolators as indicated below:

1)	Air Handling Units	Neoprene Pads
2)	Vane Axial or In-line Exhaust Fans	Housed Spring Hanger Isolators
3)	Centrifugal Exhaust Fans	Free Standing Spring Isolators
4)	Pumps	Neoprene Pads

END OF SECTION

SECTION 23 05 53 - HVAC IDENTIFICATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Mechanical Identification for:

1) Ductwork systems
2) Piping system
3) Valves
4) Mechanical equipment
5) Warning signs
6) Control devices, pneumatic pipe and wiring
7) Painting

1.2 SUBMITTALS

A. Submit shop drawings in accordance with General Requirements, Division 1.

B. Submit copies valve schedule for each piping system, typewritten and reproduced on bond paper. Tabulate valve number, piping system, system abbreviation, location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses, by special "flag", in margin of schedule. Include valve schedules within Maintenance Manuals (Re: 230500) and Division 1.

PART 2. EQUIPMENT

2.1 MECHANICAL IDENTIFICATION MATERIALS

A. Stencils: Fiberboard: ANSI A13.1 letter sizes for ductwork; minimum 1-1/4" high letters for ductwork and minimum 3/4" high letters for access door signs and similar operational instructions. Stencil paint: Exterior type black.

B. Valve tags: 19 gauge polished brass, 1-1/4" diameter, stamp engraved black enamel fitted. Valve tag fastener shall be solid brass chain.

1) At Contractors option, valve tags may be 3/32" thick engraved plastic laminated valve tags, within piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high letters, and with 5/32" hole for fastener. Valve tag shall be white with black lettering.

C. Valve schedule frames: For each page of valve schedule, provide glazed display frame with screws for removable mounting on masonry walls. Frame shall be extruded aluminum with SSB-grade sheet glass.

D. Plastic Labels for Equipment:

1) Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 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 (71 deg C).
5) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6) Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.
8) Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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.

E. 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.

F. Lettering Size: At least 3/4 inches high.

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 DUCTWORK IDENTIFICATION

A. Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow. Locate identification in each space where ductwork is exposed, or concealed only by removable ceiling system and near points where ductwork originates or continues into concealed enclosures, (shaft, underground or similar concealment) and at 50 foot spacing along exposed runs.

B. Access doors shall have stenciled type signs on each access door in ductwork and housings. Indicate purpose of access (to what equipment); and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 PIPE LABEL INSTALLATION

A. 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7) On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule shall be per the following table:

Pipe System	Legend	Letter Color	Background Color
Low Pressure Steam (15psig)	LPS	Black	Yellow
Heating Hot Water Supply	HHWS	Black	Yellow
Heating Hot Water Return	HHWR	Black	Yellow
Chilled Water Supply	CHWS	White	Green
Chilled Water Return	CHWR	White	Green
Low Pressure Condensate	COND	Black	Yellow

3.4 VALVE IDENTIFICATION INSTALLATION

A. Valve tag location: Provide valve tag on all valves, cocks, and control devices in each piping system. List each tagged valve in valve schedule for each piping system. Mount valve schedule frames and schedules in machine room where directed by Owner's Representative.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate signs except where lettering larger than 1" is required for proper identification. Locate signs in or near each piece of mechanical equipment and each operation device.

1) Provide plastic laminated signs at main control and operating valves, fans, pumps, meters, gauges, thermometers, thermostats, VAV boxes, fan terminal units, duct mounted coils, control devices, sensors, fans and primary balancing dampers.

2) Laminated tags, at a minimum, shall be provided for each piece of equipment scheduled on drawings.

B. All temperature sensors, differential pressure switches, and control devices integrated with the building control systems shall be permanently marked to indicate normal operating points or range for both summer and winter operation. Coordinate with Engineer and Owner prior to marking. In addition, all room sensors shall have laminated tags mounted adjacent to the room sensor on wall or within the cover of the sensor itself. The laminated tag shall indicate the device which the sensor serves; (RC-1, VAV-1 etc.).

3.6 WARNING AND DANGER SIGNS

A. Where identifications signs are required to indicate a warning or danger, signs shall be plastic laminated with red background and white lettering. At a minimum warning signs shall be provided as follows:

1) All air handling unit access doors to fans and access doors downstream of fan discharge and elsewhere as required, to indicate an unsafe condition.

2) All motor driven equipment that automatically starts shall include a warning sign indicating such. Coordinate wording of danger sign with facility manager.

END OF SECTION

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SECTION 23 05 93 –TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Air and hydronic balancing of air handling systems including humidifiers.

B. Air balancing of each diffuser, grille and register at air volume indicated on the drawings.

C. Start-up of services for air handling units and pneumatic and electronic control systems.

D. Validation assistance of control systems.

1.2 QUALITY ASSURANCE

A. Testing, balancing and start-up services shall be done by an Independent Contractor. The Independent Contractor shall have a proven record of doing TAB work for a period of at least 3 years. At the Owners request, references may be requested from the Contractor to verify past performance.

B. Submit evidence that personnel who perform testing and balancing of project systems are qualified personnel; for review and approval by Owner prior to performing work.

C. Submit list of completed projects successfully tested and balanced by submitted, qualified personnel for review and approval by Owner prior to performing work.

D. Perform all corrective measures caused by faulty installation; re-test, re-adjust and re-balance systems until satisfactory results are achieved.

E. Qualified personnel are:

1) Personnel certified by one of the following organizations:
   (a) AABC - Associated Air Balance Council
   (b) Certified TBAB - Certified Testing, Balancing and Adjusting Bureau
   (c) NEBB - National Environmental Balancing Bureau
   (d) TABIC - Test & Balancing Institute for Certification

2) Personnel Registered as a Professional Engineer.

1.3 SUBMITTALS

A. Preliminary:

1) Submit three copies of documentation to confirm compliance with Quality Assurance provisions:
   (a) Organization supervisor and personnel training and qualifications
   (b) Specimen copy of each of report forms proposed for use

B. Second: At least fifteen days prior to starting field work submit three copies of the following:

1) Set of report forms filled out indicating design flow values and required CFM for all diffusers.

   Complete list of instruments proposed to be used, organized in appropriate categories, with data sheets for each instrument. Furnish the following information:

   (a) Manufacturer and model number
   (b) Description and use when needed to further identify instrument
   (c) Size or capacity range
   (d) Latest calibration date

2) Engineer will review submittals for compliance with Contract Documents and return one set marked to indicate the following:

   (a) Discrepancies noted between data shown and Contract Documents
   (b) Additional or more accurate instruments required
   (c) Requests for re-calibration of specific instruments

C. Third: At least fifteen days prior to Contractor's request for final inspection, submit three copies of final reports on applicable reporting forms for review.

1) Schedule testing and balancing of parts of systems delayed due to seasonal, climatic, occupancy or other conditions beyond control of Contractor as early as proper conditions will allow, after consultation with Engineer.

2) Submit reports of delayed testing promptly after execution of those services.

3) Form of Final Reports:

(a) Each individual final reporting form must bear signature of person who recorded data and TAB supervisor of reporting organization.

(b) When more than one certified organization performs TAB services, the firm having managerial responsibility shall make the submittals.

PART 2. EXECUTION

2.1 START-UP SERVICES

A. Prior to beginning Testing, Adjusting and Balancing (TAB) work the Independent TAB Contractor shall perform all start-up services as follows:

1) Inspect all bearings for cleanliness and alignment. Bearings which are found to be defective shall be noted as such to the Owner for replacement by the installing Contractor. Grease as necessary all bearings in accordance with the manufacturer's instructions.

2) Adjust tension for all drives and adjust variable pitch drives to the RPM scheduled or noted on shop drawings.

3) Check each motor for amperage comparison to nameplate value. Motors which produce excessive current flow shall be noted as such to the Owner so corrections can be made by the installing Contractor.

4) Check electrical control circuits to insure that operation complies with the Specifications.

5) Inspect each pressure gage and thermometer for calibration.

2.2 HYDRONIC BALANCING

A. Make measurements in accordance with recognized procedures and practices of certifying association. Water flows shall be balanced to within ± 5 percent of design requirements.

B. Check conditions at cooling and heating coils for required performance at design conditions.

C. Mark all balancing devices as specified.

2.3 AIR BALANCING

A. Make measurements in accordance with recognized procedures and practices of certifying association. Measure air volume discharged at each outlet and adjust air outlet to design air volumes within ± 5 percent. Adjustments made for building envelope to maintain pressure relationship specified hereinbefore shall be coordinated with the Owner.

B. Adjust fan speeds and motor drives within drive limitations for required air volume. Set speed to provide air volume at farthest distance without excess static pressure.

C. Mark all balancing dampers and cocks.

D. Upon completion of addition, Test & Balance contractor shall be responsible for balancing new rooftop air handling and dedicated outside air energy recovery units.

2.4 COORDINATION

A. Coordinate services with work of various trades to insure rapid completion of services.

B. Promptly report to Engineer any deficiencies noted during performance of services to allow immediate corrective actions to be performed.

END OF SECTION

SECTION 23 07 13 – HVAC DUCT INSULATION

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Duct Insulation

1.2 RELATED DOCUMENTS

A. American Society for Testing and Materials
   1) Flame Spread: 25 or less; ASTM E84, NFPA 255
   2) Smoke Developed: 50 or less; ASTM E84, NFPA 255

B. National Fire Protection Association, NFPA:
   1) Composite ductwork lining installation including lining, sealers, mastics and adhesives, NFPA 255 method with Flame spread rating 25 or less and Smoke developed rating: 50 or less.
   2) NFPA No. 90A and 90B

1.3 QUALITY ASSURANCE

A. Insulation shall not be applied until all ductwork has been tested and approved and thoroughly cleaned. All insulation work shall present a neat appearance with smooth and uniform surfaces. Work done in a slovenly manner will not be acceptable. All insulation joints shall be carefully fitted and tightly butted. All jacket materials shall be neatly applied with smooth surfaces and shall be securely adhered or pasted in place. All seams and joints shall be located so that they are as inconspicuous as possible. Exposed edges and ends of all insulation shall be sealed and finished to provide a complete, unbroken vapor seal. The Contractor shall install insulation to be continuous through pipe sleeves.

B. Failure, due to faulty workmanship or material, of any portion of the installed insulation to perform the function as intended by these specifications, either stated or implied, for a period of one (1) year after acceptance of the project by the Owner, shall be the responsibility of the Contractor and shall be rectified at no additional cost to the Owner. This shall include the loosening of any jacket material, the appearance of condensation on the outside of the insulation, or any other mechanical or thermal failure which affects either appearance or efficiency of installation.

1.4 SUBMITTALS

A. Submit shop drawings for all insulating materials in accordance with Division 1.

B. Shop Drawings:
   1) Submit shop drawings which indicate complete material data, mastics, adhesives, list of materials proposed for this project and indicate thickness of material for individual services.

C. Product Data:
   1) Provide current manufacturer's data to show compliance with these specifications and governing regulations; include proof of compliance for test products of products for fire and smoke rating, corrosiveness and compressive strength.

PART 2. EQUIPMENT

2.1 DUCT INSULATION

A. Material - Insulate all new supply air and outdoor air intake ducts, exhaust air ducts, ductwork exposed to outdoor weather, ducts located where the ambient temperature is greater than the temperature of the air within the duct system and at all locations where condensing on ductwork is possible unless noted otherwise with 1½" thick flexible glass fiber blanket, approximately 1 lb/cu ft density, with a K value of 0.26 at 75° F. The insulation shall be suitable for temperatures up to 250° F. Furnish and install insulating jacket, Factory-applied foil-scrim-kraft vapor barrier.

B. Manufacturer:
   1) Certain-Teed Corp: Standard Duct Wrap Type IV
   2) Knauf: Duct Wrap-FSK

3) Manville Corp.: R Series Microlite-FSKL
4) Owens-Corning: Faced Duct Wrap-FRK 25-

PART 3. EXECUTION

3.1 METHOD OF INSTALLATION

A. Duct Insulation:

1) Systems shall be completely covered throughout, including fittings and accessories. All fittings and accessories shall be accessible for maintenance. Unless specified otherwise, insulation shall extend continuous through sleeves.

2) All adhesives, tape and any other material used for sealing shall be applied in strict accordance with manufacturer's instructions which includes covering rate of application, method of application, temperature limits for application of said materials, or any other condition affecting efficiency or permanence of the installation.

3) All external surface of ductwork shall be wiped clean before installation of insulation. Insulation shall be wrapped on exterior of ductwork with all joints butted and all longitudinal seams overlapped not less than 2". Insulation shall be adhered to metal ductwork with not less than 4" strips of insulation adhesive, applied to ductwork at not greater than 8" O.C. On ducts wider than 18", the insulation on bottom of ductwork shall be additionally secured with welding pins secured to ductwork at not greater than 18" O.C. All joints, all longitudinal seams, all welding pins, and all penetrations shall be applied so that compressed thickness at corners of ductwork is not less than 1". Seal joints and breaks (in ducts conveying air at less than room temperature) with 4" wide strips of open mesh glass cloth or tape imbedded between 2 coats of vapor barrier sealant. Point up other joints and breaks with hydraulic setting cement.

4) The completed installation shall form a smooth and neat appearance.

3.2 EXISTING INSULATION

A. Repair insulation damaged or disturbed during construction with approved, similar materials, installed to match existing. Install new jacket lapping and sealed over existing.

3.3 ACCESSORIES

A. Provide bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers recommended by insulation manufacturer for application indicated. Do not use staples. Provide adhesives, cements, sealers, mastics and protective finishes recommended by insulation manufacturer for application indicated.

3.4 OUTDOOR PROTECTION

A. All outdoor insulation shall be covered with a weather protective jacket consisting of 22 gage aluminum or 26 gage stainless steel protective covering. Edges of exterior jacket shall be securely closed around insulation to prevent rain, snow, dirt, etc. from damaging the underlying insulation in any fashion.

END OF SECTION

SECTION 23 31 13 – HVAC DUCTWORK

PART 1. GENERAL

1.1 WORK INCLUDES

A. Ductwork
B. Access doors
C. Volume dampers
D. Branch Takeoff Fittings
E. Backdraft dampers
F. Motor operated dampers
G. Fire dampers
H. Fire smoke dampers
I. Turning vanes
J. Rooftop hoods

1.2 RELATED DOCUMENTS

A. National Fire Protection Association, NFPA:
1) NFPA 90A: Air Conditioning and Ventilating Systems.
2) NFPA 90B: Standard for Installation of Warm Air Heating and Air Conditioning Systems.

B. Underwriter's Laboratories, UL:
1) UL 181: Factory-Made Duct Materials and Air Duct Connections.
(a) American Conference of Governmental Industrial Hygienists: Industrial Ventilation.
(b) American Society of Heating, Refrigerating and Air Conditioning Engineers, ASHRAE:
(c) Sheet Metal and Air Conditioning Contractors National Association, Inc., SMACNA:
(d) SMACNA: HVAC Duct Construction Standards; First Edition 1985.

1.3 SUBMITTALS

A. Submit shop drawings for all materials in accordance with Division 1.

B. Product Data:
1) Submit manufacturer's catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of manufactured ductwork accessories.
2) Include pressure drop curve or chart for each type, and size of motorized control damper.
3) Submit schedule showing manufacturer's figure number, size, location, rated capacities, and features for each fire damper, and control damper.
4) Submit fire protection rating, maximum velocity/pressure ratings and manufacturer's installation instructions for each fire damper. Velocity/pressure ratings shall include both ducted and non-ducted data.
5) Submit manufacturers certified test data on dynamic insertion loss, self-noise power levels and aerodynamic performance for reverse and forward flow test for each duct silencer.

C. Airflow Monitoring and Control
1) Submit product data sheets for airflow measuring devices indicating minimum placement requirements, sensor density, sensor distribution, and installed accuracy to the host control system.
(a) Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
(b) Submit a schedule of airflow measuring devices indicating compliance with specified accuracy at minimum and maximum airflow rates.
(c) Submit installation, operation and maintenance documentation.

D. Shop Drawings:
1) Submit ¼" scale fabrication drawings showing all necessary fittings, dampers and access doors.

2) Coordinate fabrication drawings with field conditions prior to submittal. Changes in layout and design required to accommodate actual field conditions shall be specifically noted on drawings.

PART 2. EQUIPMENT

2.1 RECTANGULAR SHEET METAL DUCTWORK

A. Comply with ductwork type per the schedules on drawings.

B. Where ductwork is indicated to be exposed to view in occupied spaces, provide materials free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains, discoloration, and other imperfections, including those which would impair painting. Sizes shown on drawings for rectangular ducts are sheet metal sizes, and where applicable an allowance has been made for duct liner insulation.

C. Ductwork shall be ASTM G90 galvanized steel: ASTM A525, lock-forming quality, 1.25 oz. zinc coating each side; (paint grip type where painted in exposed locations.). Gage, reinforcing and construction shall be in accordance with SMACNA Manual "HVAC Duct Construction Standards".

D. Longitudinal and corner seams shall be Types L1, L3 or L6 and in accordance with Figure 1-15 of SMACNA Manual "HVAC Duct Construction Standards".

E. Transverse joints and seams shall be made in accordance with Figure 1-4 of the SMACNA Manual "HVAC Duct Construction Standards" and of the following types:

1) Joints in the two sides of ducts shall be drive slip type T-1, T-2, or T-3.

2) Joints in the top and bottom of ducts shall be drive slip type as specified for sides, or shall be "S" slip types T-6, T-10, T-11, or T-14.

F. All take-offs from mains ducts shall be made using a 45° clinch collar to promote air flow in the direction of the take-off.

G. Housings and plenums shall be constructed of not less than 18 gage galvanized sheet steel with minimum l½" x l½" x 3/16" and 2" x 2" x 3/16" galvanized steel angles spaced at 4'-0" or less on centers for rigid and sturdy installation. Ducts less than 15" in depth may be reinforced with angles on top and bottom only.

H. The foregoing reinforcing for ducts and housings is the minimum and additional reinforcing shall be installed where necessary for elimination of excessive vibration and movement, and where in the opinion of the Engineer, additional reinforcement is necessary. Housing connections to walls, floors and ceilings shall be made airtight with angles and silicone based sealant. Angles shall be securely attached to the housing and the building construction.

I. Construct tees, bends, and elbows with radius minimum 1-1/2 times width of duct on center line. Where not possible and where rectangular elbows are used, provide single blade type turning vanes. Transitions in ductwork shall be tapered to an angle not to exceed 15 degrees unless specifically shown or approved otherwise.

J. Round branch takeoffs from rectangular ductwork shall be accomplished with round bellmouth fittings, constructed of heavy duty 24 gauge galvanized steel. Bellmouth takeoffs shall include air-tite 0.125” neoprene gasket to ensure a tight fitting with minimal leakage. Pre-drilled holes shall be provided for quick mounting. Bellmouth fitting shall be constructed utilitizing automated machinery to ensure consistent sizing.

1) At contractor’s option, or as required in locations where listed duct height does not accommodate, round branch takeoffs shall be high efficiency 45° rectangular to round (HETO) fitting. HETO fittings shall be constructed of galvanized steel (ASTM A653 and A924) with G-60 galvanized coating. Fitting to be designed per SMACNA Third Edition 2005 section 4.8 Figure 4-6.

2) All branch takeoff fittings shall be provided with volume dampers, regardless if shown on plan or not. Volume dampers shall be as specified herein.

K. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A 167; Type, 304; with No. 4 exterior finish where exposed to view in occupied spaces, No. 2B finish elsewhere. At a minimum stainless steel ductwork shall be provided on all low-wall returns from the frille to the first 90-degree elbow or fitting above the ceiling line. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

L. Shop fabricate ductwork in 12 ft maximum lengths. Construct and reinforce ductwork as indicated in SMACNA's Standards as specified above.

M. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections.

N. Fabricate duct fittings to match adjoining ducts, or equipment and to comply with duct requirements as applicable to fittings. Fabricate radius elbows with center-line radius equal to associated duct width; and include turning vanes in shorter radius elbows where necessary.

2.2 ROUND SHEET METAL DUCTWORK (CONCEALED AREAS)

A. Comply with ductwork type per the schedules on drawings.

B. All round ductwork shall be ASTM G90 galvanized inside and outside and shall be manufactured by a company who has had the manufacture of spiral duct as its principal business for at least 10 years. Round and flat oval sheet metal ducts shall be installed where indicated on the drawings.

C. Sheet metal gages and construction of round ducts shall be in accordance with the SMACNA Manual "HVAC Duct Construction Standards" for pressure class indicated on drawings. If pressure class is not indicated the ductwork shall be constructed to 2" w.g. pressure class.

D. Duct and fittings shall be installed with beaded slip joints fabricated on the fittings and couplings. Before assembly the outside of the joint slips shall be painted with duct adhesive/sealant and slipped into the mating duct. The connection shall be completed by utilizing sheet metal screws spaced at not more than 6 inches around the circumference of the duct. Use a minimum of 3 screws for all connections.

E. Branches from ductwork shall be accomplished with saddle tap fittings or lateral fittings. 90 degree takeoff fittings are not allowed.

F. Where coupling is used between two pieces of duct fittings, the fastening as stated above shall apply for each piece joined by a coupling. After fastening with screws, all excess adhesive shall be wiped clean from the outside of the ductwork.

G. Longitudinal seams shall be spiral type and transverse joints shall be beaded sleeve type RT-1 or companion flange type RT-2 as shown in figure 3-2 of the SMACNA Manual "HVAC Duct Construction Standards". Round ducts shall be supported with not less than 1" wide, 16-gauge galvanized steel straps as shown in figure 4-4 of the SMACNA Manual "HVAC Duct Construction Standards".

H. The use of wire for the support of round ducts will not be acceptable. The complete installation of duct systems shall provide a neat appearance, with duct runs hung level and without noticeable sag or misalignment.

I. Manufacturers:

1) Lindab
2) Semco
3) Wesco
4) Eastern Sheet Metal

2.3 DOUBLE WALL ROUND SHEET METAL DUCTWORK (EXPOSED AREAS)

A. Comply with ductwork type per the schedules on drawings.

B. All round ductwork shall be ASTM G90 galvanized inside and outside and shall be manufactured by a company who has had the manufacture of spiral duct as its principal business for at least 10 years. Round and flat oval sheet metal ducts shall be installed where indicated on the drawings.

C. Outer Duct shall 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 (refer to on-drawing schedule).

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) Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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."

3) 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. Gauge thickness for inner and outer ducts shall depend on ductwork diameter, per the following table:

Duct Diameter (in)	Inner Duct Gauge	Outer Duct Gauge
<12”	26	26
12” < 24”	24	24
24” < 34”	24	22
34” < 48”	22	20
> 48”	Per SMACNA	Standards

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°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. The use of wire for the support of round ducts will not be acceptable. The complete installation of duct systems shall provide a neat appearance, with duct runs hung level and without noticeable sag or misalignment.

G. Exposed ductwork shall be field painted, color as selected by architect. Refer to architectural plans and specifications for painting requirements.

H. Manufacturers:
1) Lindab, Inc.
2) Semco
3) McGill Airflow

2.4 ROUND FLEXIBLE INSULATED DUCTS

A. Flexible ducts shall be round, insulated duct, factory fabricated of a spring steel wire helix or flat steel spiral covered by and bonded to a polymeric or vinyl-coated fiberglass fabric for leak-tight air seal. Inner liner shall be covered with 1" thick glass fiber insulation and an outside flexible, puncture-resistant and scuff resistant vapor barrier jacket.

B. Duct shall be U.L. listed, Class I, and shall conform to the requirements of NFPA 90A. Ducts shall be rated for not less than 4" W.G. static pressure and for air velocities up to 2500 fpm.

C. Flexible duct sizes and installation shall be as shown on the drawings. Flexible duct connections to rectangular ducts or plenum housings shall be made with spin-in fittings equipped as hereinbefore specified.

D. The inner lining shall be secured in place to the spin-in fitting or round duct with nylon or steel draw-bands for an airtight connection. The insulation and outer vapor barrier jacket shall be drawn up to completely cover the connection and shall be secured in place with a second nylon or steel draw-band for a vaportight connection.

E. The maximum installed length of the flexible duct shall not exceed 5 feet. Flexible ducts shall be supported with not less than 1" wide, 16 gage steel straps, the use of wire for the support of flexible ducts will not be allowed.

F. Manufacturers:

1) Thermaflex: G-KM
2) Wiremold
3) Atco

2.5 ACCESS DOORS IN DUCTS AND HOUSINGS

A. All ducts and housing shall have hinged access doors for access to all automatic dampers, temperature sensing elements, control devices, fire dampers, damper actuators, air filters and all other items within the ductwork or housing which requires inspection, service or adjustment.

B. All access doors shall be sandwich type construction with insulation between the outer and inner sheet metal panels. Frame shall be minimum 22 gage galvanized steel with seal. Door shall be hinged and minimum 22 gage galvanized steel with 1" thick fiber glass insulation. Access doors shall be rated for minimum 2" w.g. static pressure.

C. Doors shall be gasketed with neoprene or sponge rubber gaskets. Foam plastic gaskets will not be accepted. The Contractor shall be responsible for the location of all access doors regardless of notations on drawings.

D. Access doors in ductwork shall be the size indicated on the drawings. Where the size is not shown the minimum size shall be 12" x 18". Where the ductwork dimensions will not accept this size, the access door shall be as large as the ductwork dimensions will accept.

E. All access doors in ductwork for access to fire dampers, motor operated control dampers, or counterbalanced backdraft dampers shall have view ports of wire-glass or Plexiglas. The access doors shall be gasketed airtight with an area of not less than 25 sq. inches for observation of dampers.

F. Hardware: Continuous aluminum piano type hinge; 1 cam latch, except 2 cam latches on sizes over 14 " x 14".

G. Manufacturers:

1) Ruskin Mfg. Co.: ADHW-24
2) Air Balance, Inc.
3) Prefco

2.6 RECTANGULAR VOLUME DAMPERS

A. Where shown on plans, and where required to properly balance the airflow in the HVAC supply, return, and exhaust ductwork systems provide rectangular, manual balancing type, volume control dampers.

B. Frames shall be minimum 16 gage galvanized steel channel construction with corner braces. Frame sizes shall be available from 6" x 5" to 48" x 48". Fabricate single blade volume dampers for duct sizes to 9-1/2" x 30". Axles shall be 1/2" hex with molded synthetic bearings. Control shaft shall be 3/8" square plated steel construction.

C. Damper blades shall be maximum 8" wide with opposed blade operation, and 16 gage galvanized steel construction. Damper blades shall be center and edge crimped and positively locked to hex axles. Provide factory mounted locking hand quadrants.

D. All volume dampers within the laboratory exhaust system shall be constructed of type 304 stainless steel with nylon shafts. Attachments shall be made with stainless steel screws and sealed airtight with acid-resistant elastomeric silicone based sealant.

E. Manufacturers:

1) Ruskin Mfg. Co.: MD35 Series
2) Air Balance, Inc.
3) Dowco Corp.
4) Nailor Industries

2.7 ROUND VOLUME DAMPERS

A. Where shown on plans, and where required to properly balance the airflow in the HVAC supply, return, and exhaust ductwork systems provide round, manual balancing-type, volume control dampers.

B. Frame and blade shall be minimum 20 gage galvanized steel construction. Frame sizes shall be available from 4" to 20" diameter. Control shaft shall be 3/8" square axle shaft extending beyond frame through factory mounted, locking hand quadrant.

C. Bearing construction shall be molded synthetic. Finish shall be mill galvanized. Damper assembly shall be suitable for 1500 fpm velocity, and 250°F operating temperature.

D. All volume dampers within the laboratory exhaust system shall be constructed of type 304 stainless steel with nylon shafts. Attachments shall be made with stainless steel screws and sealed airtight with acid-resistant elastomeric silicone based sealant.

E. Manufacturers:

1) Ruskin Mfg. Co.: MDRS25 Series
2) Air Balance, Inc.
3) Dowco Corp.
4) Nailor Industries

2.8 VOLUME DAMPERS

A. Where shown on plans, and where required to properly balance the airflow in the HVAC supply, return, and exhaust ductwork systems provide rectangular, manual balancing type, volume control dampers. Provide with cable control above inaccessible ceiling systems and manual quadrant where accessible.

B. Furnish and install, at locations shown on plans, in accordance with schedules and as needed to balance airflow in HVAC systems. Provide commercial grade control dampers and remote cable control system that meet the following minimum standards. Dampers mounted in inlet of diffuser are not acceptable. Ceiling access panels are not acceptable.

C. Dampers shall be round butterfly design or rectangular opposed blade design for low pressure drop. Round damper shall be heavy duty spiral shell with a 20 ga. "V" style blade, CRS steel shaft and oil impregnated bronze bearings requiring no lubrication.

D. Rectangular dampers shall be opposed blade style for even distribution of air over face of grille. Damper shall be constructed of .050 extruded aluminum double channel frame and stainless steel hardware including the damper slide. Blades shall be .050 extruded aluminum with longitudinal reinforcing beads. Blades shall be installed in individual Teflon blade bushings in the damper frame. Manufacturer shall supply all necessary hardware for simple installation of remote cable controls system including the Bowden aluminum angle bracket and the Bowden control hub to accommodate the cable control system mounted on the damper.

E. Cable control system shall consist of Bowden cable .054" stainless steel control wire encapsulated in 1/16" flexible galvanized spiral wire sheath to insure positive operation for up to 50' (less if there are multiple turns or bends). Control kit shall be designed for use with internally or externally controlled round or rectangular dampers and shall consist of 14 ga. Steel rack and pinion gear drive to convert rotary motion to push-pull motion. Control shaft shall be D-style flattened _" diameter with 265 degree rotation providing graduations for positive locking control. Control mounting through ceiling via 1" or 3" inconspicuous access port.

F. Manufacturers:

1) Young Regulator

2.9 BRANCH TAKE-OFF FITTINGS

A. Where shown on plans provide from rectangular ductwork to round branch ductwork high efficiency take-off type fitting. This fitting shall be minimum 24 gauge, have minimum 1/4" diam. Shaft thru damper, and have locking quadrant. Square to round transition shall be minimum 26 guage.

B. Fitting shall be equal to Buckley model BMD-HD with damper if shown on the plans. Fitting shall be minimum 22 gauge with full rod thru damper (not clamping), adjustable quadrant setpoint (no wing nut setting), and bell type take-off.

C. Equal fitting can be conical type or HETO type (rectangular to round) take-off. Spin-ins are not allowed.

2.10 GRAVITY OPERATED BACKDRAFT DAMPERS

A. Unless noted otherwise furnish and install gravity operated backdraft dampers for all roof mounted exhaust fans and where indicated on drawings. Damper frames shall be minimum 0.090" wall thickness, 6063T5 extruded aluminum with mitered corners.

B. Blades shall be minimum 0.050" wall thickness, 6063T5 extruded aluminum with extruded vinyl edge seals. Blades shall be fitted with synthetic bearings. Damper linkage shall be concealed within the frame construction.

C. The damper assembly shall be suitable for operation from -40°F to 200°F, and air velocities of 2500 FPM. Maximum backdraft airflow shall not exceed 12 CFM per square foot of damper at 0.5" w.g. static pressure differential.

D. Backdraft dampers shall be mounted inside the roof curb for roof mounted exhaust fans (except laboratory process exhaust fans). The maximum force required to fully open the backdraft damper shall not exceed 0.15" w.g. static pressure differential.

E. Manufacturers:
1) Ruskin Mfg. Co.: BD2/A2 Series
2) Air Balance, Inc.
3) Carnes
4) Perfco
5) Advanced Air

2.11 COUNTERBALANCED BACKDRAFT DAMPERS

A. Unless noted otherwise furnish and install counterbalanced backdraft dampers as indicated on drawings. Damper frames shall be minimum 0.090" wall thickness, 6063T5 extruded aluminum with mitered corners.

B. Blades shall be minimum 0.025" wall thickness, formed aluminum with extruded vinyl edge seals. Blades shall be fitted with Zytel bearings. Damper linkage shall be 1/8" x 1/2" aluminum tie-bars concealed within the frame construction.

C. The damper assembly shall be furnished with field adjustable, zinc plated, counterbalance weights securely fastened to the damper blades. The counterbalance weight adjustment shall be suitable for relieving airflow at a minimum 0.01" w.g. static pressure differential.

D. Manufacturers:
1) Ruskin Mfg. Co.: CBD2 Series
2) Air Balance, Inc.
3) Carnes
4) Perfco
5) Advanced Air

2.12 MOTOR-OPERATED DAMPERS (RECTANGULAR)

A. Where shown on plans provide rectangular, motor operated, low leakage, opposed blade type, control dampers of the sizes indicated.

B. Low leakage dampers shall have published leakage data certified under ACMA certified ratings program showing leakage through a 48"x 48" damper at 4" w.g. pressure difference to be not less than 6.2 cfm/sq.ft.

C. Damper frames shall be constructed from 5" x 1" x .125" 6063T5 extruded aluminum hat channel with hat mounting flanges on both sides of frame. Each corner shall be reinforced with two die formed internal braces and machine staked for maximum rigidity.

D. Damper blades shall be airfoil type extruded aluminum (maximum 6" depth) with integral structural reinforcing tube running full length of each blade. Blade edge seals shall be extruded vinyl double edge design with inflatable pocket which shall enable air pressure from either direction to assist in blade to blade seal off. Blades seals shall be locked in extruded blade slots without the use of cement, yet shall be easily replaceable in the field.

E. Bearings shall be non-corrosive two piece molded synthetic. Axles shall be square or hexagonal (round not acceptable) to provide positive locking connections to blades and linkage.

F. Manufacturers:

1) Ruskin Mfg. Co.: Series CD-60
2) Arrow United Industries
3) Penn Ventilator Co., Inc.
4) Nailor Industries

2.13 STATIC FIRE DAMPERS

A. Where shown on plans, in horizontal ducts passing through fire rated partitions and in vertical ducts passing through fire rated floors, furnish and install static type fire dampers. Dampers shall be interlocking folding blade type, with the blades located outside of the air stream. Dampers shall be furnished with a steel sleeve and retaining angles from the damper manufacturer to insure appropriate installation.

B. Dampers shall be constructed to comply with NFPA Bulletin 90A. Static fire dampers shall be constructed and tested in accordance with the current edition of Underwriter's Laboratories standard for fire dampers UL-555. Each static fire damper shall be marked with a UL classified 1-1/2 hour fire protection rating and "for use in static systems only".

C. Furnish each damper with 165°F fusible links for supply, return, and exhaust ducts or openings. The installation of dampers shall be in accordance with instructions to be provided by the manufacturer, describing the Underwriter's Laboratories approved installation procedure.

D. Damper frame shall be a minimum of 20-gauge galvanized steel channel mounted outside of the air stream with air tight construction. Blades shall be a minimum 24 gage galvanized steel construction, interlocking folding blade arrangement with blades stored outside of the air stream. Duct collars shall be a minimum 24 gage galvanized steel construction.

E. Horizontal dampers shall be furnished with constant force type, stainless steel closure springs. Damper frame types are indicated by symbols on drawings and shall be as herein specified:

1) Type "F1": Dampers shall be Ruskin type IBD2, Style "C" frame with collars for rectangular ductwork connections and suitable for vertical or horizontal installation.

2) Type "F2": Dampers shall be Ruskin type IBD2, Style "CR" frame with collars for round ductwork connections and suitable for vertical or horizontal mounting.

3) Type "F3": Dampers shall be Ruskin type IBD2, Style "CO" frame with collars for flat-oval ductwork connections and suitable for vertical or horizontal mounting.

F. Space between fire damper sleeve and the building construction shall be tightly sealed off with galvanized steel angle frame (not less than 10 ga.) on each side of opening, attached to fire damper sleeve and to building construction, and to comply with UL and NFPA requirements for fire damper installation.

G. Where dampers are installed in ductwork and are not located behind a removable air grille or register, the Contractor shall provide an airtight access door for access to the damper and fusible link and for inspection, regardless of whether access is indicated on drawings or not.

H. Each fire damper shipment shall include the manufacturer's UL installation instructions. All fire dampers shall be installed in accordance with the manufacturer's UL installation instructions.

I. Manufacturers:

1) Ruskin Mfg. Co.: IBD2
2) Air Balance, Inc.
3) Carnes
4) Perfco
5) Nailor Industries
6) Advanced Air

2.14 DYNAMIC FIRE DAMPERS

A. Where shown on plans, in horizontal ducts passing through fire rated partitions and in vertical ducts passing through fire rated floors, furnish and install dynamic type fire dampers. Dampers shall be interlocking folding blade type, with the blades located outside of the air stream. Dampers shall be furnished with a steel sleeve and retaining angles from the damper manufacturer to insure appropriate installation.

B. Dampers shall be constructed to comply with NFPA Bulletin 90A. Dynamic fire dampers shall be constructed and tested in accordance with the current edition of Underwriter's Laboratories standard for fire dampers UL-555. Each dynamic fire damper shall be marked with a UL classified 1-1/2 hour fire protection rating, the maximum velocity/pressure rating for both horizontal and vertical installation and "for use in dynamic systems". Dampers marked "for static systems only" shall not be installed in dynamic air handling systems.

C. Furnish each damper with 165°F fusible links for supply, return, and exhaust ducts or openings. The installation of dampers shall be in accordance with instructions to be provided by the manufacturer, describing the Underwriter's Laboratories approved installation procedure.

D. Damper frame shall be a minimum of 20 gage galvanized steel channel mounted outside of the air stream with air tight construction. Blades shall be a minimum 24 gage galvanized steel construction, interlocking folding blade arrangement with blades stored outside of the air stream. Duct collars shall be a minimum 24 gage galvanized steel construction.

E. Horizontal and vertical dampers shall be furnished with constant force type, stainless steel closure springs. Damper frame types are indicated by symbols on drawings and shall be as herein specified:

1) Type "F1": Dampers shall be Ruskin type DIBD2, Style "C" frame with collars for rectangular ductwork connections and suitable for vertical or horizontal installation.

2) Type "F2": Dampers shall be Ruskin type DIBD2, Style "CR" frame with collars for round ductwork connections and suitable for vertical or horizontal mounting.

3) Type "F3": Dampers shall be Ruskin type DIBD2, Style "CO" frame with collars for flat-oval ductwork connections and suitable for vertical or horizontal mounting.

F. Space between fire damper sleeve and the building construction shall be tightly sealed off with galvanized steel angle frame (not less than 10 ga.) on each side of opening, attached to fire damper sleeve and to building construction, and to comply with UL and NFPA requirements for fire damper installation.

G. Where dampers are installed in ductwork and are not located behind a removable air grille or register, the Contractor shall provide an airtight access door for access to the damper and fusible link and for inspection, regardless of whether access is indicated on drawings or not.

H. Each fire damper shipment shall include the manufacturer's UL installation instructions. All fire dampers shall be installed in accordance with the manufacturer's UL installation instructions.

I. Manufacturers:
1) Ruskin Mfg. Co.: DIBD2
2) Air Balance, Inc.
3) Carnes
4) Perfco
5) Advanced Air
6) Nailor Industries

2.15 CLASS III COMBINATION FIRE SMOKE DAMPERS

A. Where shown on plans, in horizontal ducts passing through fire smoke rated partitions and in vertical ducts passing through fire smoke rated floors, furnish and install combination fire smoke rated dampers. Each combination fire smoke damper shall be 1-1/2 hour rated under Underwriter's Laboratories Standard UL-555, and shall be further classified by Underwriter's Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL-555S, and shall bear a UL label attesting to the same.

B. The damper manufacturer shall have tested, and qualified with UL a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper

size is not acceptable. The leakage rating under UL-555S shall be no higher than leakage class III (40 cfm/sq. ft. at 1" w.g. static pressure; 80 cfm/sq. ft. at 4" w.g. static pressure).

C. As part of the UL qualification, the dampers shall have demonstrated a capacity to operate both open and closed under HVAC system operating conditions with pressures of at least 4" w.g. in the closed position, and 2000 FPM air velocity in the open position.

D. The dampers and the actuators shall be qualified under UL-555S to an elevated temperature of 250°F, 350°F, or 450°F depending upon the actuator. Electric actuators shall be factory installed. The damper/actuator assembly shall be supplied as a single entity which meets all applicable UL-555 and UL-555S qualifications for both dampers and actuators.

E. Provide factory assembled sleeve minimum 16" long. Sleeves shall be minimum 20 gage for dampers up to 84" wide, and 18 gage for dampers over 84" wide. Damper and actuator assembly shall be opened and closed at the factory a minimum of ten cycles to demonstrate proper and reliable damper operation.

F. Damper frames shall be a minimum of 16 gage galvanized steel structural hat channel with tabbed corners for reinforcement Bearings shall be a stainless steel sleeve turning inside an extruded hole in the frame. Blades shall be minimum 16 gage galvanized steel construction with three longitudinal grooves for reinforcement. Jamb seals shall be stainless steel flexible metal compression type. Blade action shall be parallel.

G. Space between fire damper sleeve and the building construction shall be tightly sealed off with galvanized steel angle frame (not less than 10 ga.) on each side of opening, attached to fire damper sleeve and to building construction, and to comply with UL and NFPA requirements for fire damper installation.

H. Where dampers are installed in ductwork and are not located behind a removable air grille or register, the Contractor shall provide an airtight access door for access to the damper and fusible link and for inspection, regardless of whether access is indicated on drawings or not.

I. Provide factory fabricated style CR transition duct connections for round ductwork. Provide factory fabricated style CO transition duct connections for flat-oval ductwork. Each combination fire smoke damper shipment shall include the manufacturer's UL installation instructions.

J. Furnish each damper with 165°F fusible links for supply, return, and exhaust ducts or openings. The installation of dampers shall be in accordance with instructions to be provided by the manufacturer, describing the Underwriter's Laboratories approved installation procedure.

K. Manufacturers
1) Ruskin: FSD35
2) Air Balance
3) Prefco
4) American Warming
5) Nailor Industries

2.16 TURNING VANES

A. Constructed of same material as ducts where they are installed, but minimum 22-gauge, non-adjustable 90 degree turns. Turning vanes shall be single thickness, formed blade shape. Turning vanes shall be positioned and held in place with pre-formed guide rails. They shall be airfoil type.

B. Manufacturers:

1) Aerodyne airfoil
2) Barber-Colman
3) Carnes Co.
4) Tuttle and Bailey

2.17 LOW PROFILE ROOF MOUNTED HOODS

A. Provide low profile roof mounted hoods designed for intake, exhaust or relief airflow as indicated on plans and as scheduled. Hoods and bases shall be aluminum or galvanized steel, riveted and welded construction and shall be watertight at all seams and joints. The cap shall be constructed of not less than 18 gauge aluminum or 20 gauge galvanized steel. The base shall be not less than 14 gauge aluminum or 16 gauge galvanized steel.

B. Hoods shall be available in throat sizes 12" x 12" through 36" x 96". The height for a 36" x 96" unit shall not exceed 24" from the top of the roof curb to the top of the hood assembly. Furnish and install roof curb for each hood. Hoods and curbs shall be installed watertight and the installation shall be coordinated with the roofing installer. The hood base shall be securely anchored to the curb to withstand wind pressures. Where indicated on drawings, dampers shall be furnished and installed for the hood.

C. Surfaces shall be of type that will accept field painting without having to field treat the surfaces to accept paint. Interior of units shall have factory applied anti-condensate coating and units shall be furnished with bird screens.

D. Hood bases shall be hinged and provided with padlock hasps for padlocking. The anchoring of the hasp components shall be such that they cannot be removed when in the locked position.

E. Hoods shall be furnished with throat dimensions as shown on drawings. Large hoods shall be internally reinforced with structural angles, or standing seam construction to provide a secure and rigid unit. The static pressure drop through units shall not exceed the scheduled value.

F. Manufacturers:
1) Loren Cook Co.: Type VR or VI
2) Penn Ventilator Co., Inc.: Airette
3) Greenheck Fan Corp.: Fabra Hood

PART 3. EXECUTION

3.1 INSPECTION

A. Visit job site prior to fabrication and installation to verify all requirements, connections and conditions. Provide instructions to all parties with regard to shop drawing information and requirements.

B. Starting work indicates acceptance of other in-place work.

C. Before installation inspect building dimensions and service rough-in, including means of access for conditions affecting shop fabrication, equipment delivery and the installation of all ductwork and accessories.

D. Provide inserts and anchors into other work for the support of this work.
1) Ensure these items are installed in the proper locations.
2) Include fastening devices to attach work.
3) Use the proper fasteners and anchors for the materials encountered and the operation and service of the equipment.

E. Install ductwork and all accessories in accordance with the manufacturer's instructions using workers skilled and familiar with the items and the installation specifications.

F. Shop assemble and test work prior to delivery to job site wherever possible. Sequence the installation and erection of work to ensure mechanical and electrical connections are affected in an orderly and expeditious manner.

G. Coordinate all cutting, fitting and patching with the other trades involved to ensure a complete and finished installation.

3.2 METHOD OF INSTALLATION

A. Comply with all of the manufacturer's best installation recommendations and instructions for all ductwork and accessories.

B. Furnish and install roof curbs for all roof mounted ductwork and accessories. Curbs shall be as specified in Section 230529 of these specifications and the height shall be as indicated on drawings, but shall be not less than 13½" from base to top of nailer strip.

C. Securely anchor roof curb to roof structure. Securely anchor ductwork and accessories to roof curb. Coordinate flashing and counterflashing with roofing installer for a watertight installation.

D. Items with hinged bases shall be furnished with padlock hasps for padlocking. The anchoring of the hasp components shall be such that they cannot be removed when in the locked position.

E. Furnish and install all steel members and accessories necessary to provide a complete and finished installation.

F. Ducts shall be constructed, sealed and made airtight for pressures indicated on drawings. If pressure class is not indicated on the drawings, the ducts shall be sealed to 2" w.g. pressure class. All ducts shall be sealed in accordance with SMACNA Seal Class A. Fabricate and seal ductwork to maintain a maximum air leakage, inward or outward as follows:

1) Each 50 feet main or branch duct: 1%.

2) Total leakage any complete system: 5% of total air handled.

G. Provide openings in ductwork to accommodate thermometers and controllers. Provide pitot tube openings for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings provided in insulated or lined ductwork, install insulation material inside metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities to the greatest extent possible.

I. Furnish and install all manually operated volume dampers, and devices where indicated on drawings and as required to insure proper balancing and control of air systems. Volume controllers shall be equipped with proper type operators for adjustment with final balance position clearly marked.

J. The interior of all ducts and boots that can be seen through grilles, registers and diffusers shall be coated with flat black paint, except where duct is lined with black coated insulation.

K. Where exposed ductwork passes through non fire-rated walls the space between the duct and the opening shall be closed with a compacted fill of 3/4 lb. density fiberglass. Provide and install sheet metal collar of not less than 20-gauge paint-grip type galvanized sheet steel on all side of the ductwork. Overlap the opening and ductwork by 1½" on all sides. Seal collars around ductwork and opening with silicone elastomeric sealant.

L. The space between fire damper sleeve and the building construction shall be tightly sealed off with galvanized steel angle frame (not less than 10 ga.) on each side of opening. Securely attached angles to fire damper sleeve and to building construction to comply with UL and NFPA requirements for fire damper installation.

M. Where dampers are installed in ductwork, and are not located behind a removable air grille or register, the Contractor shall provide an airtight access door in rectangular ducts and an airtight access panel in round ducts. These are required for access to the damper, fusible link and for inspection. Provide and install the access doors and panels regardless of whether they are indicated on drawings or not.

N. Each fire damper shipment shall include the manufacturer's UL installation instructions. All fire dampers shall be installed in strict accordance with the manufacturer's UL installation instructions.

O. Control Components: Install all control components in sheet metal equipment or ductwork as shown and/or indicated, including all automatic and manual control dampers, all flow measuring stations, all fire dampers, and all smoke dampers. Also any temperature sensors or indicators, humidity sensors or indicators, flow sensors, switches, or indicators, freeze stats, static pressure sensors, and end position switches that are not DDC controls.

P. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work. Coordinate with insulator to prevent installation of duct in such a way, that insulator cannot apply insulation.

Q. Penetrations: Where ducts pass through interior partitions and exterior walls, seal space between construction opening and duct or duct insulation with sealant and sheet metal flanges of two gauges heavier than duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate. Where ducts pass through fire rated floors, walls, or partitions, provide fire dampers, or fire/smoke

dampers if indicated and provide firestopping between duct and substrate, as specified in Section 230500.

R. Rectangular tees, bends and elbows shall be provided with turning vanes. In addition, provide manually operated volume dampers, as indicated and as needed, to ensure proper balancing and control of air systems.

3.3 FLEXIBLE DUCTS

A. Flexible duct shall only be used where shown on the drawings. The inner liner shall be secured in place to the round duct with nylon or steel draw-bands and sealed for an airtight connection, and then the insulation and outer vapor barrier jacket shall be drawn up to completely cover the connection and shall be secured in place with a second nylon or steel draw-band for a vapor tight connection.

B. Flexible ducts shall be supported with 2" wide, 20 gauge steel straps, the use of wire for the support of flexible ducts is not acceptable. Where flexible duct is used as a bend or elbow, the included angle or the bend shall not exceed 90 degrees in any plane.

1) Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.

3.4 START-UP AND TESTING

A. Leakage Tests: After each duct system or portion of a duct system is completed, this contractor shall test the section in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. The tests shall verify that the entire duct system for each air handling unit has a total leakage rate of 1% or less of the total system design cfm. Leakage from non-duct components (fire dampers, smoke dampers, volume control boxes, etc.) are an integral part of overall system leakage, and these components shall be included in duct leakage tests. Contractor shall be responsible for any remedial efforts directed at products in order to bring the system or section into compliance with the leakage rate specified.

B. Provide all blank off covers, fan connection points, and test holes required. Seal up of all test holes and removal of all covers after section of duct or entire duct system has been tested and approved as acceptable.

C. By means of a suitable fan and test manometers, the systems shall be pumped up to approximately 3.5" w.g. of static pressure and held for a period of ten (10) minutes. After this period the pressure shall be reduced to 2" w.g. of static pressure and the duct systems shall be visually and audibly inspected to determine that all joints are tight. After all leaks are properly sealed, the duct shall be repressurized to 3.5" w.g. of static pressure and held for ten (10) minutes and then reduced again to 2" and all leaks rechecked. Contractor shall repair leaks and repeat tests until total leakage is less than 1% of total system design air flow.

D. Contractor is responsible for the costs associated with any retests required due to total system duct leakage greater than the 1% of total cfm value.

E. Contractor is responsible for submitting copies of certified calibration data for leakage test apparatus and the reports on the leakage tests. The report shall give an accurate description of the test procedure and results including any remedial action that was needed to obtain an acceptable test. Owner or Owner's Representative may be present for tests at Owner's discretion.

3.5 ADJUSTING AND CLEANING

A. Remove protective ductwork caps or cover as it is being installed.

B. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Balancing: This contractor shall provide the initial balancing and adjusting of all air handling systems. All final testing and balancing will be by a testing and balancing contractor. This

contractor shall assist during the final balancing and testing. Refer to Specification Section - "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork. Seal any leaks in ductwork that become apparent in the balancing process.

E. Clean, inspect and adjust dampers prior to system start-up to ensure equipment is operational and complete in all respects, including all accessories. Verify that all dampers are in the proper position before starting equipment.

END OF SECTION

SECTION 23 37 13 – HVAC DIFFUSERS, REGISTERS AND GRILLES

PART 1. GENERAL

1.1 DESCRIPTION OF WORK

A. Diffusers
B. Grilles and Registers
C. Outside Louvers
D. Roof Hoods

1.2 RELATED DOCUMENTS

A. Air Diffusion Council, ADC

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, ASHRAE:

1) Make air flow test and sound level measurements in accordance with ADC Equipment Test Codes and ASHRAE Standards.

C. National Fire Protection Association, NFPA:

1) NFPA 90A: Air Conditioning and Ventilating Systems
2) NFPA 90B: Standard for Installation of Warm Air Heating and Air Conditioning Systems

1.3 QUALITY ASSURANCE

A. The manufacturer shall provide the Owner with a one-year warranty. The manufacturer shall replace any equipment, assembly or part that fails due to defective material or workmanship during the warranty period.

B. Upon written notice from the Owner or Engineer the Contractor shall promptly repair any defects occurring within a one-year period from the date of final acceptance. All warranty work shall be performed by the Contractor without any cost to the Owner.

1.4 SUBMITTALS

A. Submit shop drawings for all materials in accordance with Division 1, Section 013300.

B. Shop Drawings:

1) Submit shop drawings covering each item together with schedule of outlets and inlets.

C. Product Data:

1) Submit manufacturer's data for air distribution equipment, including specifications, capacity and noise criteria. Furnish catalog cut sheets, product specifications and dimensioned drawings for each type of diffuser, grille, register, louver and hood.

2) Include performance tables marked to clearly indicate CFM, pressure drop, neck velocity, throw and noise criteria value for each item submitted.

3) Throw values shall be given in feet to terminal velocities of 150 FPM, 100 FPM and 50 FPM. All pressures shall be given in inches of water.

4) Catalog cut sheets shall be clearly marked in red ink to indicate the performance data for each item submitted.

5) Submit certified copies of tests showing water penetration for louvers in accordance with AMCA Standard 500 and complying with the requirements of the AMCA Certified Ratings Program.

6) Submit anodize finish color charts for louvers with shop drawings.

PART 2. EQUIPMENT

2.1 GENERAL REQUIREMENTS

A. Rate units in accordance with ADC standards. Base air outlet application on space noise level of NC 35 maximum. Provide baffles to direct air away from walls, columns, or other obstructions within the radius of diffuser operation.

B. Provide boots of same manufacturer as grille or register fitted with equalizer deflector or diffuser plate as noted or scheduled on drawings. All units shall be furnished with sponge rubber gasket seal around edge with mounting surface secured in place. Foam plastic gaskets are not acceptable. All units shall have finish as specified.

C. Where supply registers are installed on exposed ductwork provide an inverted collar on the duct. The outside dimensions of the inverted collar shall be the same as the outside dimensions of the register so that the edges are even with one another. The depth of the collar shall be sufficient to contain the register and volume control damper within the collar. The register and damper shall not extend back into the duct. The collar shall not be in excess of the depth of the register and damper.

D. Refer to Architectural reflected ceiling drawings for the type of ceiling construction to determine the exact mounting frame required for each ceiling mounted grille, register and diffuser.

E. Provide quantity and sizes of grilles, registers and diffusers as indicated on drawings. Coordinate with other work, including ceiling layout, ductwork and ductwork accessories, to interface installation of units properly with other work and existing conditions.

F. Provide reinforcing bars on the back side of blades for grilles and registers when blades are 12" long or greater. Install grilles and registers for minimum sight through unit when viewed from floor.

2.2 REGISTERS

A. Supply Register SG-1 shall be steel, rectangular, double deflection type, with individually adjustable horizontal and vertical blades. Furnish units with heavy formed 1-1/4" steel borders and countersunk screw holes suitable for surface mounting.

1) Blades shall be spaced 3/4" on centers with friction pivots which allow individual blade adjustments without loosening or rattling. Front blade shall be parallel to the long dimension. Registers shall be furnished with gang-operated, opposed blade type, volume control dampers. Dampers shall be adjustable from the face of the register with screwdriver.

2) Secure overlapping frame of register to inverted duct collar, or to wall construction with oval head, countersunk screws. Screw heads shall be enameled to match the border. Finish for registers shall be off-white baked enamel.

3) Manufacturers:

(a) Titus: 272RL
(b) E.H. Price: 520L
(c) Carnes Co.: RTDA
(d) Nailor Industries

B. Return Registers RG-2 shall be steel construction and rectangular configuration. Provide one set of fixed blades parallel to the long dimension. Registers for lay-in ceiling installation shall be furnished with Titus type 3 borders. Registers for installation in walls or hard ceilings shall be furnished with Titus type 1 border for surface mounting.

1) Blades shall be spaced 1/2" on centers with 30° deflection. Registers shall be furnished with gang-operated, opposed blade type, volume control dampers. Dampers shall be adjustable from the face of the register with screwdriver.

2) Secure overlapping frame of register to inverted duct collar, wall or ceiling construction with oval head, countersunk screws. Screw heads shall be enameled to match the border. Finish for registers shall be off-white baked enamel.

3) Manufacturers:

(a) Titus: 30RL
(b) E.H. Price
(c) Krueger

2.3 CEILING SUPPLY DIFFUSERS

A. Supply Diffuser SD-1, SD-2, and SD-3 shall be 12" x 12" or 24" x 24" square plaque face type as shown on the drawings, with round neck ductwork connection. Diffusers for lay-in ceiling

installation shall be furnished with Titus type 3 borders. Diffusers for installation in hard ceilings shall be furnished with Titus type 1 border for surface mounting.

1) Diffusers shall deliver airflow in a 360° pattern unless blank-off plates (sectorizing baffles) are indicated on the drawings. Blank-off plates shall be installed in the neck of the diffuser when shown to alter the discharge pattern for walls, columns or other obstructions.

2) Provide a Titus model D-75 opposed blade damper for final trim balancing (to within 5%). Each branch takeoff shall also be provided with manual volume damper for balancing purposes, per to Specification Section 233113. Integral damper shall be suitable for installation with flexible ductwork, and shall be accessible by removal of plaque face. Finish for diffusers shall be off-white baked enamel.

3) Manufacturers:

(a) Titus: OMNI
(b) E.H. Price: SPD
(c) Krueger

B. Supply Drum Louvers DL-1 shall be a high capacity, long throw type. Outer borders shall be 1-1/4" wide and shall be constructed of heavy gauge extruded aluminum. Corners shall be assembled with full penetration resistance welds with a reinforcing steel patch for extra strength. Provide with heavy gauge steel opposed blade damper, operable from face of grille.

1) Screw holes shall be countersunk for a neat appearance. Drum shall be constructed oF heavy gauge extruded aluminum and shall rotate a minimum of 25 degrees up and down from center line of diffuser. Heavy extruded aluminum blades shall be individually adjustable.

2) Drum Louvers shall be extruded aluminum with #26 finish. Louver shall be provided with curved frame, with foam gasket seals, for spiral duct mounting.

3) Manufacturers:

(a) Titus: S-DL
(b) E.H. Price
(c) Krueger

2.4 GRILLES

A. Return Grilles RG-1 and RG-3 shall be 24" x 24" or 24" x 12" perforated steel construction with a flush face and one-piece stamped heavy gauge backpan. Grilles for lay-in ceiling installation shall be furnished with Titus type 3 borders. Grilles for installation in walls or hard ceilings shall be furnished with Titus type 1 border for surface mounting.

1) Perforations shall be minimum 3/16" diameter on 1/4" staggered centers and no less than 51% free area. Neck of grilles shall have 1-1/8" depth for easy duct connection.

2) Return grilles shall be steel construction with #26 finish. Finish shall be anodic acrylic paint, baked at 315° for 30 minutes. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

3) Manufacturers:

(a) Titus: PAR
(b) E.H. Price
(c) Krueger

B. Exhaust Grilles EG-1 and EG-2 shall be 24" x 24" or 24" x 12" perforated steel construction with a flush face and one-piece stamped heavy gauge backpan. Grilles for lay-in ceiling installation shall be furnished with Titus type 3 borders. Grilles for installation in walls or hard ceilings shall be furnished with Titus type 1 border for surface mounting.

1) Perforations shall be minimum 3/16" diameter on 1/4" staggered centers and no less than 51% free area. Neck of grilles shall have 1-1/8" depth for easy duct connection.

2) Return grilles shall be steel construction with #26 finish. Finish shall be anodic acrylic paint, baked at 315° for 30 minutes. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint

must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

3) Manufacturers:

(a) Titus: PAR
(b) E.H. Price
(c) Krueger

2.5 OUTSIDE LOUVERS

A. Louvers shall be 4" deep, drainable, extruded aluminum with stationary blades. Frame and blade thickness shall be not less than 0.081". Louver assembly shall be constructed and reinforced with structural supports to withstand wind velocities up to 90 MPH without damage.

B. Each louver blade shall be extruded with drain gutter at bottom of blade, and each blade shall drain into integral downspout in side frames and intermediate mullions. Louvers shall be furnished with framed removable 3/4" x .051" expanded flattened aluminum bird screen attached to back side of louvers.

C. Free area velocity through the louvers shall not exceed 800 FPM for overall size shown and for the full air quantity shown for the air handler unit or fan. The pressure drop through the louver shall not exceed 0.1" W.C. at 800 FPM free area velocity.

D. Louvers shall have water penetration not to exceed 2.5 oz. of water per sq. ft. (by weight) in 15 minutes at free area velocity of 800 FPM and at rainfall rate of 4 inches per hour. The ratings shall be based on tests made in accordance with AMCA Standard 500 and shall comply with the requirements of the AMCA Certified Ratings Program. The louver manufacturer shall submit certified copies of the tests, for the type of louvers proposed, showing water penetration for the sizes indicated on drawings.

E. Louvers installed in masonry or concrete walls shall have box channel frame. Louvers installed in framed openings shall have flanged frame. Louvers shall be furnished with caulking slots and installed airtight in the wall opening. Louvers shall be caulked all around with silicone based caulking compound. Verify the size of louver and the opening into which the louver will be installed before ordering.

F. Seal frame to insure water tight conditions. Seal lower half of connecting ductwork with mastic and pitch so water will drain out through the frame. The louver shall have anodized bronze finish of color shade as selected by the Architect. Submit anodize finish color charts with shop drawings.

G. Manufacturers:

1) Ruskin Mfg. Co.
2) Pottorff
3) Arrow Louver and Damper Corp.

PART 3. EXECUTION

3.1 INSPECTION

A. Visit job-site prior to installation to verify all conditions, connections, and instruction to all parties with regard to shop drawings. Starting work means acceptance of other in-place work.

B. Before installation, inspect building dimensions and rough-in, including means of access, for conditions affecting delivery and installation.

C. Before work is installed, Architect/Engineer reserves right to make modifications to location of items to provide satisfactory coordination between Contractors.

D. Provide inserts and anchors built into other work for support of this work.

1) Ensure these items are installed in their proper location.
2) Include fastening devices to attach work.
3) Use proper anchoring devices for materials encountered and usage expected.

3.2 METHOD OF INSTALLATION

A. Install grilles, registers, diffusers, louvers, hoods and accessories in accordance with manufacturer's instructions using workers skilled and familiar with items and installation specifications and procedures.

B. Sequence installation and erection to ensure work is effected in orderly and expeditious manner. Do cutting, fitting and patching, coordinating work fully with other crafts involved. Locate all ceiling mounted grilles, registers and diffusers according to Architectural reflected ceiling drawings.

3.3 START-UP, TESTING AND TRAINING

A. Clean, test, balance and adjust equipment prior to start-up to ensure systems are operational and complete in all respects, including all accessories. Testing and balancing specified in Section 230593.

END OF SECTION

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SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Grout.
4. Common electrical installation requirements.

1.2 SPECIFICATION FORM AND DEFINITIONS

A. Design Engineer, hereinafter abbreviated D/E shall mean the Engineering firm, Olsson Associates, 1251 NW Briarcliff, Kansas City, MO, Telephone (816) 361-1177. Contact person: Cory Wilson.

A. All drawings and specifications on the project are complementary, each to all other sets, and they shall be used in combination for the execution of this work. Division 26 work shown on any one set of drawings, including all Architectural drawings for general work and equipment, and Division 26 work called for under any section of the project specifications, shall be considered as included in this work unless specifically excluded by inclusion in some other branch of the work. This shall include roughing-in for connections and equipment as called for or inferred. The Contractor shall check all drawings and specifications for the project and shall be responsible for the installation of all Division 26 work.

B. The contract drawings for Division 26 work are in part schematic, intended to convey the scope of work and indicate the general layout, design and arrangement. The Contractor shall follow these drawings in the layout of his work and shall consult general intent construction drawings, structural drawings mechanical drawings and all other drawings for this project to determine all conditions affecting the Division 26 work. The contract drawings are not to be scaled and the Contractor shall verify spaces and conditions in which the Division 26 work is to be installed.

C. Where specific details and dimensions for Division 26 work are not shown on the drawings, the Contractor shall take measurements and make layouts as required for the proper installation of the work and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications that have not been clarified by addendum prior to bidding, it shall be assumed by the signing of the contract that the higher cost (if any difference in costs) is included in the contract price, and the Contractor shall perform the work in accordance with the drawings or with the specifications, as determined and approved by the Architect, and no additional costs shall be allowed by the contract price.

1.3 WORK INCLUDED

A. This work shall include all plant, labor, material and equipment as required to furnish and install Division 26 work including demolition as shown on drawings and as hereinafter specified. Work shall also include all plant, labor, material and equipment not shown on drawings and not specified but necessary and reasonably incidental to comply with the intent of contract to provide first class and complete installations of Division 26 work. Furnish and install all materials, equipment, devices, and accessories not specifically called for by item but that are necessary to provide the requirements in operation and function that is established by the design and by the equipment specified.

B. Work shall also include:

1) The procurement of and payment for all permits and licenses required for the performance of the work;

2) All fees and direct expenses involved in any inspections required for the project;

3) All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.

4) All job measurements and shop layouts required for the proper installation of material and equipment included in the work.

5) All lights, guards, and signs as required by safety regulations applicable to the work;

6) The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work;

7) Any modifications or revisions required to existing plant, facility, or systems necessary to perform work as called for or inferred.

C. Work shall include providing labor and equipment for current and voltage readings, and adjustments required on Division 26 equipment for testing and balancing of mechanical systems as specified in, Division 22 and 23 of this specification.

D. The work shall include revisions, modifications, and rework of the existing plant, facility, or systems as required for installation of new work, and for connections between existing work and new work where required. The work shall also include the completion of existing electrical and control circuits, for devices and equipment that are to remain in service, if the circuits are broken by demolition work, or by the removal or cutting of existing building construction, existing devices or equipment. Existing conduit and wiring shall be rerouted where necessary.

E. Electrical work includes, but is not limited to:

1) Alterations and additions to existing electrical systems;

2) Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system;

3) Complete alterations and additions to for telephone VoIP system (cabling only);

4) Connection of all appliances and equipment including Owner furnished equipment;

5) Complete [alterations and additions to] normal and egress lighting and power system, including:

(a) Individual battery units

6) Complete alternations and additions to fire alarm system.

7) Complete central office grounding system.

8) Complete temporary facilities for construction power.

1.4 SHOP DRAWINGS AND SAMPLES

A. Acceptance of the work shall be subject to the Architect's approval of shop drawings, product data and samples. Shop drawings shall include manufacturer's detail drawings of equipment and material and Contractor's shop drawings of equipment and material and Contractor's shop details for installation of material and equipment. Descriptive literature shall include catalog data covering design, size and capacity of material and equipment. Samples shall be parts or complete units of material and equipment made available for inspection by the Architect. Samples shall be as requested by the Architect.

B. Submittals shall include the manufacturer's model number, capacity, performance data, electrical characteristics, etc., all clearly shown and marked for the specific item of equipment to be furnished on this project. General catalog data that does not indicate the specifics for the item to be furnished for this project will not be accepted. Performance data shown or marked on the submittals shall be at the actual specified operating conditions for this project.

C. The Contractor shall, prior to forwarding shop drawings to the Architect, review all shop drawings, check all conditions and make all corrections and sign and date each set. No shop drawings will be reviewed by the Architect without signature of Contractor which will signify that he has checked drawings.

D. When Shop Drawing submissions are in the form of portable document format (PDF), they shall be transmitted via email to the contact information provided during the pre-construction conference. Each submittal transmitted in PDF format shall include only one specification section. Multiple specification section submittals combined into one singular PDF file will not be accepted. The cover page of the submittal shall include all necessary information for proper identification of project, submittal, and date, and shall include a blank area, minimum 4-1/4" by 5-1/2" in size, for placement of the engineer's review stamp. The email transmittal and PDF file naming shall be compliant with the following guidelines:

1) Email submittals to be addressed to: TBD, as instructed during pre-construction conference.

2) Email subject line shall include the following information, in order of listed below and separated by dashes:
   (a) "SUBMITTAL"
   (b) Project Number (as listed in titleblock and specifications).
   (c) Specification Section Number
   (d) Specification Title
   (e) "FOR REVIEW"
   (f) Example: "SUBMITTAL-14071.1-262416-Panelboards-FOR REVIEW"
3) The PDF file for the actual submittal shall be compliant with the following guidelines:
   (a) Project Number (as listed in titleblock and specifications).
   (b) Specification Section Number
   (c) Sequence Number (separated from section number by a 'dot'). In the case of a resubmittal, the sequence number shall remain the same as the previously submitted file, and shall be
   (d) Specification Title
   (e) "FOR REVIEW"
   (f) Example: "14071.1-262416.01-Panelboards-FOR REVIEW.pdf".
4) Failure to follow email transmittal or document naming guidelines will result in an automatic rejection of submittal.

E. Other requirements for shop drawings shall be as specified in the "General Conditions" of these specifications, and in each appropriate specification section.

1.5 RECORD DRAWINGS

A. The Contractor shall keep a day-to-day record of all changes or variations made from the contract drawings and at the end of the project shall obtain reproducible mylars, at the Contractor's cost, of the original contract drawings for Division 26 work and show all changes from the original plans made during the installation of his work. Any reference to Addendum and Change Orders shall be deleted from mylars. Drawings shall indicate but not be limited to the following:
   1) The correct location of lighting fixtures, feeder conduits, and other equipment where it differs from the location shown on the drawings
   2) The location of all switches, receptacles, security devices, panelboards, junction boxes, etc.
   3) Any other information of a pertinent or useful nature
   4) Any change order items not issued on supplementary drawings

B. All notations shall be made in a neat and legible manner with any additional explanatory drawings or sketches necessary.

C. The complete set of Record Drawings shall be delivered to the Architect at the completion of the work. Final payment will not be made until Record Drawings are received.

1.6 CONDUCT AND SEQUENCE IN PERFORMING WORK

A. The Contractor shall be responsible for a scheduled sequence in performing the work so that it will not interfere with the building occupant's operation in the existing building. Before any work is started, the Contractor shall consult with the Owner's designated Representative and arrange a satisfactory schedule. The schedule shall be as approved by the Architect. Make temporary alterations as required to execute work so that all operations and services in the existing building are maintained with the minimum possible interruption. Temporary shut-downs shall be segregated and shall be of the shortest possible duration. All facilities shall be kept in continuous operation unless specific permission to the contrary is arranged by the Architect and or the Owner's designated Representative.

B. The Contractor shall provide to the Owner's designated Representative, prior to any shut down of power or systems, a typewritten detailed proposed procedure of shut down outlining each step including estimated time during the shut down procedure, during the actual shut down, and during the start procedure. These procedures shall also indicate all equipment and systems that will be

effected by the shut down. The Contractor shall not proceed with any shut down without approval of the procedure from the Owner's designated Representative or the Owner.

1.7 EXISTING MATERIAL AND EQUIPMENT

A. Existing material and equipment removed from existing construction and not shown or required to be reused shall become the property of the Owner, if they so elect. The Contractor shall present the equipment and materials removed to the Owner's designated Representative and he shall select the equipment and materials which he elects to retain. Material and equipment not retained shall become the property of the Contractor and shall be promptly removed from the site.

B. Any existing material or equipment which is to be reused or left in place and is damaged by performance of work under this contract shall be repaired or shall be replaced with new equipment and material at the expense of the Contractor, to the satisfaction of the Owner and the Architect.

1.8 MATERIAL AND MANUFACTURE

A. All material and equipment shall be new except as stated otherwise; shall be of the best quality and design; shall be free from defects and imperfections and shall have markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. As possible, all material and equipment of the same type shall be of the same manufacturer. Equipment shall function and perform efficiently and quietly at the required capacity without producing objectionable noise within the occupied areas of the building; if not, the Contractor shall remedy the condition or replace the equipment at no additional cost to the contract.

1.9 SUBSTITUTIONS

A. Reference in the specifications to any article, device, product, material, fixture, equipment, form or type of construction by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Any article, device, product, material, fixtures, equipment, form or type of construction other than those specified may be substituted, in accordance with the preliminary matters, general conditions, supplemental conditions applicable unless otherwise specified if in the opinion of the Architect, it is equal in every respect to that specified.

B. All products proposed for use, including those specified by required attributes and performance shall require approval by the Architect before being incorporated into the work. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Architect. Approved substitutions for proprietary materials and systems will be considered, however, approval must be requested prior to use. Burden of proof of equal quality, appearance, performance, and utility rests with the Contractor. Submit technical data and other pertinent information to the Architect.

C. Where the phrase "or equal" or "approved equal" occurs in the contract documents, do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Architect/Engineer. The decision of the Architect/Engineer shall be final.

D. Where indirect lighting systems have been specified on the drawings or hereinafter the Contractor shall be responsible for providing to the Owner and the Architect all supporting calculations, dimensional data, detailed layouts, samples, etc. for consideration prior to bidding. This information shall reach the Architects office no later than 7 days prior to the bid date. Lighting systems that do not meet the criteria specified hereinafter under Section 265100 will not be considered as an approved equivalent.

1.10 LABOR, WORKMANSHIP AND SUPERVISION

A. All labor for the installation of material and equipment furnished under the Division 26 work shall be done by experienced mechanics of the proper trade and all workmanship shall be first class and in compliance with the specific requirements of drawings and specifications.

B. All material and equipment for the Division 26 work shall be installed under competent supervisory service furnished by the Contractor. Where necessary, this shall include the services of special erection and operation personnel.

1.11 SAFETY REGULATIONS

A. All Division 26 work shall be performed in compliance with all applicable and governing safety regulations including the regulations of the Occupational and Safety Health Act. All safety lights, signs and guards required for performance of Division 26 work shall be provided by the Contractor.

1.12 PERMITS AND LICENSES

A. All permits and licenses that are required by governing authorities for the performance of Division 26 work shall be procured and paid for by the Contractor.

1.13 CODES, ORDINANCES, REGULATIONS AND U.L. APPROVAL

A. All Division 26 work shall conform to the requirements of all applicable codes, ordinances and regulations including the current rules and regulations of the [National Electrical Code], the [National Fire Protection Association], O.S.H.A. and all state and local laws, codes and ordinances.

B. Laws, codes, ordinances and regulations shall take precedent excepting only where the work called for by the drawings and specifications exceeds by quality and quantity.

C. Fixtures, appliances, equipment and materials which are subject to Underwriter's Laboratory tests shall bear such approval.

1.14 CONTRACTOR'S EQUIPMENT

A. All hoists, scaffolds, staging, runways, tools, machinery and equipment required for the performance of the Division 26 work shall be furnished by the Contractor.

1.15 COORDINATION AND COOPERATION

A. The Division 26 trades shall cooperate and confer with all other trades on the project, as to locations of their materials and equipment before erecting the work so as to avoid interference and delay in progress of construction. In instances where interference may develop, the Contractor shall relocate his work as approved by the Architect, to depart from such interferences at no additions to the contract price. Where it is necessary to make adjustments in the locations or routing of conduits, wireways, or other installations (from that shown on drawings) to clear obstructions or other installed work, the Contractor shall be responsible for making these adjustments as a part of the contract work.

B. The Contractors shall coordinate with the Owner's designated Representative as to scheduling his work in all areas and shall obtain approval from the Owner's designated Representative prior to any disruption of services or activity. All shut down of services shall be maintained to a minimum.

1.16 STORAGE AND PROTECTION

A. Material and equipment for the Division 26 work shall be protected from dirt and damage and maintained in a clean condition during the performance of the work. This shall include adequate protection from the weather if storage is outside. All parts of material and equipment that have become rusted or damaged shall be replaced or restored to an acceptable condition as approved by the Owner's designated Representative. This shall include factory finishes damaged during construction. Any refinishing shall be spray painted, brush applied paint will not be acceptable.

PART 2 - PRODUCTS

2.1 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.

2.2 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 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: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating 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.

2.4 PRE-CONSTRUCTION ELECTRICAL INSTALLATION CONFERENCE

A. The contractor shall schedule and coordinate a pre-construction electrical installation conference attended by the Owner's representative and the Engineer. The purpose of this conference is to provide an overview of the contract requirements, drawings and specifications. The contractor shall be responsible for recording and distributing the minutes of the conference. Schedule this conference within 14 calendar days of the receipt of Notice to Proceed.

2.6. MANUFACTURER'S STANDARD PRODUCTS

A. It is the intention of these contract documents, drawings and specifications, to require manufacturers' standard products, equipment, components and accessories to complete the work.

B. The equipment, components and accessories furnished by the Contractor shall be the manufacturer's standard, off-the-shelf products as modified only by the manufacturer's standard options and accessories. Do not provide prototypical equipment, components and accessories when standard, off-the-shelf products are available. Standard products that do not meet these specifications shall not be custom-manufactured or otherwise modified to meet the specifications, but shall be rejected.

C. The Engineer shall make the final determination whether standard, off-the-shelf products are available, and whether any given product is the manufacturer's standard product.

D. The products of approved manufacturers meet the intent of these specifications.

2.7. MOTORS, CONTROLS, AND OTHER EQUIPMENT

A. Except as otherwise specified, the Division 26 work shall include receiving, installing and mounting all detached motors, switches, motor control equipment and other control devices furnished under other divisions of work. Contractor shall check all headings of specifications for equipment to be installed. Work shall include mountings and supports as required for all equipment, including angle frames, steel plates, bars, bolts, etc., and all conduit, wire, etc., as required to connect all equipment including motors, disconnect switches, starters, controls, push-buttons, etc. Detached motors shall be set and aligned with coupling or drive. Motor connections shall be terminated with

unexposed leads in suitable conduit and cover. Conduit shall terminate close to motor with a minimum of 12" of flexible liquid tight conduit between rigid conduit or EMT and motor.

B. Unless specified otherwise, perform all work required to rough-in and connect to all equipment requiring electrical connections. This work shall be as indicated on drawings, by approved equipment shop drawings and by direction on the job as approved by the Architect.

C. All equipment, materials or devices furnished by others including that furnished by the Owner or under any other division which required electrical connections shall be roughed-in and connected under this division, unless specified otherwise. It shall be the Contractor's responsibility to verify exact requirements for rough-in and connection of equipment furnished by others prior to installation. Extras will not be allowed for failure to verify rough-in and connection requirements.

D. The Contractor shall run feeders to starters, disconnects, control panels and motors as shown on drawings, make connections, and install and wire all mechanical components in accordance with wiring diagrams furnished under Division 22/23 work. The Contractor shall coordinate with any other trades involved for the proper coil voltages for control of magnetic starters and contactors.

E. Unless otherwise specified or shown on the drawings, control wiring and connections for temperature control systems shall be as specified under Division 22 and 23

2.8 ADJUSTING, ALIGNING AND TESTING

A. All electrical equipment furnished under this Division shall be adjusted and tested by this Contractor. Motors and other equipment furnished by others, to which electrical connections are made under this Division, shall be checked for short circuit and open circuits before energizing. Motors shall be checked for proper phasing and rotation. The thermal overload protection devices shall be checked in all motor starters, and equipment and all protection device size, motor nameplate full load amperage, and voltage rating for protection of the motor shall be listed (include equipment designation, rating of heater, motor nameplate horsepower, full load amps and voltage) and 4 copies of list shall be submitted to the Architect.

B. Mechanism of all electrical equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required. Adjustable parts of all lighting fixtures and electrical equipment shall be checked, tested and adjusted as required to produce the intended performance.

C. Completed wiring systems shall be free from short circuits and after completion, perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

D. The Contractor shall be held responsible for the operation, service and maintenance of electrical equipment during construction and prior to acceptance by the Owner. All electrical equipment shall be maintained in the best operating condition. Operational failure caused by defective material an/or labor furnished under this Division shall be immediately corrected. Architect shall be immediately notified of any operational failures caused by defective material and/or labor covered under other Divisions or furnished by others.

2.9 ELECTRICAL CIRCUITRY FOR EQUIPMENT

A. The electrical circuits, components, and controls for all equipment are selected and sized, based on the equipment specified. If substitutions and/or equivalent equipment are furnished, it shall be the responsibility of all parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the electrical characteristics and requirements of that furnished to that specified and/or shown. If greater capacity or more materials or labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then it shall be the responsibility of the parties involved in providing the substitute and/or equivalent items of equipment to provide all compensation for additional charges made for the proper rough-in, circuitry and connections for the equipment furnished. No additional charges above the Base Bid shall be allowed for such revisions.

B. Before rough-in of circuitry or connecting to equipment, the Contractor shall verify the electrical characteristics and requirements of the equipment being furnished, and for that specified and shown on drawings.

2.10 CLEARANCES

A. All electrical equipment shall be so installed to maintain proper clearance and headroom as required by the National Electrical Code.

2.11 CUTTING AND PATCHING

A. The responsibility for any cutting of construction which is required for the installation of Division 26 work, shall be by the Contractor. The Contractor shall coordinate with all other Contractors and the Owner before any cutting and obtain approval from the Architect prior to any cutting. All patching and finishing shall be by the Contractor.

B. Cutting shall be done with extreme care and in such a manner that the strength of the structure will not be endangered. Wherever possible, openings in concrete or masonry construction shall be by concrete saw or rotary core drill. Openings in any construction shall be cut the minimum size required for the installation of the work. Adequate protection shall be provided to prevent damage to adjacent areas and to prevent dust from spreading to adjacent areas.

C. Where openings or holes are cut in existing construction and the cutting breaks existing electrical circuitry or control circuitry conduit and wiring, then it shall be the responsibility of the Contractor to reroute the circuitry conduit and rewiring and to complete the circuitry as required and as approved by the Architect. Temporary completion shall be provided where necessary before the permanent rerouting and completion work is finished.

D. Before any cutting, patching, or finishing work is started, dust and moisture protection shall first be installed as specified.

E. Openings cut in floor shall be cut by core drilling where possible. After work is installed through any opening in floor, the opening around the work shall be patched and sealed watertight and epoxy or silicone based, non-cracking elastomeric sealant.

F. Where existing work is removed from sleeves or openings through floor and the sleeve or opening is not to be reused, patch the hole or opening by filling with non-shrink epoxy cement grout, in strict accordance with the grout manufacturer's instructions and recommendations and as required to make completely watertight. Finish the floor surface as directed by the Architect..

G. Contractors bidding on this project shall coordinate prior to bidding all cutting requirements under this division with the General Contractors for patching requirements to be included in their bids. See Division 1 of the specifications for additional requirements.

H. Unless otherwise noted, x-ray existing concrete slabs, walls, etc., to locate rebar. X-ray equipment used shall include protective shielding to prevent any harmful radiation from being transmitted to surrounding working equipment. Submit complete diagram of x-ray set up and predicted radiation disbursement for review.

2.12 OPENINGS IN FIRE RATED ASSEMBLIES

A. Where openings are made, or left due to demolition through fire rated assemblies for conduit or nipples, for sleeves containing cable or wire, and for open conduits through rated assemblies the area around openings, sleeves, and conduits shall be firestopped as specified below. The area around conduits or nipples and unused openings shall be sealed and finished to match adjacent surface prior to opening. Voids up to ½" wide around conduit penetrations shall be sealed with fire resistant foam sealant as specified.

B. Where the conduit or nipple is left unused for use by others, install a pipe cap on end of raceway on each side of wall or floor.

C. Electrical boxes in fire rated walls shall be fireproofed around with Monocoat fire proofing compound as manufactured by W.R. Grace. The electrical boxes shall be completely covered with a thickness as recommended by the manufacturer and as approved by the authority having jurisdiction. Submit shop drawings on material and recommended installation.

2.13 ROOF PENETRATIONS

A. All openings in the roof for electrical conduits shall be made weather and water tight using "Stoneman" multi-flash or versa-flash seamless flashing assembly for conduit sizes through 2 inches.

Conduit sizes over 2 inches shall have pitch pockets filled with pitch and galvanized drip shield installed around conduits. The drip shield shall completely cover pitch pocket.

2.14 ACCESS PANELS

A. The contractor shall furnish all access panels for walls, partitions, etc., and shall give access panel to the General Contractor for installation at locations as directed by the Electrical Contractor.

B. It shall be the responsibility of the Electrical Contractor that access panels are provided for access to all boxes, bus joints, equipment, etc., which may be concealed by building construction to comply with the NEC and NFPA.

C. Access panels shall be installed so as not to interfere with lighting arrangements. All access panels shall be Milcor having factory prime coat finish. Use style "B" for lath and plaster surfaces, style "M" for brick surfaces, style "A" for acoustic ceilings. Use fire rated access door where required in fire rated walls. Access panels shall be 12 inches by 16 inches, except where used in acoustic ceilings which size shall be either 12" x 12" or 12" x 24".

2.15 ANCHORS

A. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved plus 100% for dead loads. Live loads shall be considered in addition to dead loads.

B. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable. Protect telephone equipment from drilling residue. Powder actuated "shot" type anchors are not allowed.

C. Use preset anchor steel inserts in concrete slabs. Provide preset anchor size and type for anticipated or specified rod/bolt size and live/dead load.

2.16 HOUSEKEEPING PADS

A. Furnish 2500 # concrete pads, 4” high, unless otherwise noted, for all freestanding equipment, i.e.: switchgear, panels, control panels, motor control centers, transformers, etc. Pads shall have 1" x 45° chamfered edges, and shall extend 4" beyond equipment mountings. Equipment pads that attach to existing equipment for a continuous line-up shall match existing pad elevations

PART 3 - EXECUTION

1.17 CLEANING

A. Dirt and refuse, resulting from the performance of the work shall be removed from the premises daily as required (broom clean) to prevent accumulation and the Contractor shall cooperate in the maintaining of reasonably clean premises at all times.

B. Immediately prior to the final inspection, Contractor shall clean all material and equipment. Dirt, refuse and stains shall be removed from all surfaces and damaged finishes restored to original condition.

1.18 NOISE AND VIBRATION

A. Contractor shall be responsible for the installation of all equipment in such a manner as to control the transmission of noise and vibration from any installed equipment or system, so the sound level shall not exceed NC35, in any occupied space. Contractor shall be responsible for the correction of any objectionable noise in any occupied area due to improperly installed equipment.

1.19 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall furnish all services as required for adequate verbal and printed instructions to the Owner and the Owner's operating and maintenance personnel for operation and maintenance of all equipment and systems installed under this Division. Three complete copies of service manuals in hardback binder shall be furnished at the end of the project in accordance with the General Conditions of the specifications. The manuals shall include printed operating and maintenance instructions for systems and equipment specified under this Division, all approved shop drawings and all manufactures printed data.

1) Data to include serial numbers, catalog/model numbers, parts lists, description of operation, final shop drawings, wiring diagrams, all electrical ratings, set-up and maintenance procedures and other literature required for maintenance of equipment. See Technical Sections for other required information.

B. When the work is complete and at a time designated by the Owner's designated Representative, the Contractor shall furnish the services of a qualified instructor to instruct the Owner's personnel in the operation and maintenance of the systems and equipment.

C. The bound copies of the operating and maintenance manuals shall be used during the verbal instructions. Maintenance Manual Requirements:

1) Provide emergency instructions including addresses and telephone numbers for service sources.

2) Provide regular system maintenance procedures

3) Indicate proper use of tools and accessories

4) Provide wiring and control diagram for each system

5) Provide manufacturer's data for each operational item in each system

6) Provide manufacturer's product warranties, and guarantee relating to the system and equipment items in the system

7) Provide Final Shop and Erection drawings relating to the system

8) Bind each operating and maintenance manual in one or more vinyl-covered, 2” 3-ring binders, plus pocket-folders for folded drawings. Index with thumb tab collated with Table of Contents for sections. Mark the back spine and front cover of each binder with system identification and volume number.

D. Maintenance Materials: Deliver all materials to the Owner in fully identified containers or packages suitable for storage. Obtain receipt for all delivered materials signed by Owner’s Operation Manager.

1.20 PROTECTION OF EXISTING AND DUST CONTROL

A. Provide and maintain dust-proof and weatherproof temporary partitions from floor to ceiling for the full length required where existing walls and/or partitions are indicated to be removed and around isolated locations where it is necessary to cut or remove portions of existing walls, ceilings, floor slabs, or partitions. Erect prior to beginning work in the following manner:

1) Construct of fire retardant treated No. 2 common S.Y.P. 2”x4” studs and ¼” thick fire retardant treated plywood. Tape all joints to be dust-proof. Fire retardant treatment shall be in accordance with the American Wood Preservers Association Standard AWPA C30B and C27B to obtain classification of 25 or less for Flame Spread and Smoke Developed rating of 50 or less. Each piece shall bear the UL label. Plywood shall be A.P.A. Grade “Sheathing Grade” or better and be laminated with waterproof glue. For interior work, fire resistive polyethylene sheet equal to Griffolyn Type 55FR (Griffolyn Houston, Texas) may be used in lieu of plywood. Flame spread rating of all materials shall be less than 25.

B. The Contractor shall provide adequate protection, wherever work is to be performed in the existing building, to prevent damage to adjacent areas, equipment, or furnishings; to prevent accidental injury to building occupants and the public; to prevent the spreading of dust, dirt, debris, and moisture from the area where work is being performed; and to prevent dust, dirt, debris, and moisture from getting on or in the building occupant's furnishings or equipment.

C. Every precaution shall be taken during handling, transporting, erection, and performing any work to prevent and eliminate dust, debris, and moisture from entering or being carried into spaces outside the work area and onto or into the building occupant's equipment or furnishings that may remain in the area of work. Cutting, patching, finishing, painting, or any other construction work which will cause dirt or dust to be created shall be separated from occupied spaces by temporary dustproof partitions or curtains sealed at top, bottom and all around. Curtains or dust catching covers may be fire-resistant polyfilm sheeting or other approved effective materials. Dust mats shall be provided as necessary and shall be kept clean to prevent tracking dust, dirt or debris from the work areas.

1.21 EXISTING CONDITIONS

A. Each bidder shall inspect the site as required for knowledge of existing conditions and failure to obtain such knowledge shall not relieve the successful bidder of the responsibility to meet existing conditions in performing the work under the contract.

B. Where new work cannot be installed without changes in existing plant, facility or systems or where it is indicated on drawings to rework an existing installation, this contract shall include alterations to existing work as required to install new work. Additions to the contract cost will not be allowed because of this Contractor's failure to inspect existing conditions.

C. Where existing power, lighting, or control circuitry is broken by removal of existing devices, equipment, or fixtures, or by demolition work, cutting or removal of existing building construction, and where the existing circuitry is required by remaining devices or equipment to stay in service, then the circuitry shall be completed as required by job conditions.

D. Existing conditions indicated on the drawings are taken from the best information available on previous contract drawings and from visual site inspection and are not to be construed as "As-Built" conditions, but are to indicate the intent of this work. It shall be the responsibility of the Contractor to verify all existing conditions at the project site and to perform the work as required to meet the existing conditions and the intent of this work indicated.

1.22 WARRANTIES

A. Warranties shall be provided for all material, labor and equipment in accordance with the requirements of the General Conditions, except that all warranties shall be non-prorated for a minimum of one year, except for items requiring additional warranty as specified otherwise in other sections of this specification.

B. Acceptance of the work under this Division shall be subject to the conditions that all installed systems, equipment, apparatus, and appliances included in the work shall operate and perform as designed, including code clearances, and as selected with respect to efficiency, capacity and quietness and shall operate and perform without producing objectionable noise within occupied areas of the building.

C. Acceptance of the work shall also be subject to the conditions that any time within one year after date of final payment, any defective part of the work resulting from the supply of faulty workmanship or material shall be immediately amended, repaired or replaced as a part of the contract work without cost to the contract.

D. This Contractor shall be responsible for warranties in accordance with the above specifications, of any equipment or materials of which is preordered by the Owner and assumed and received by this Contractor.

1.23 DEMOLITION

A. This work shall include demolition by this Contractor. Demolition shall consist of but not be limited to removal of existing wire, conduit, boxes, existing lighting fixtures, existing devices, as shown on plans or that is in the way of New Construction. This work shall include removal of all of the aforementioned items as specified or noted on drawings. It will be the Contractor's responsibility to maintain circuits and circuitry to keep areas in operation not included in demolition work but affected by the demolition work.

B. The Contractor shall coordinate with the involved telephone companies for removal of telephone cable indicated in drawings to be removed or required to be removed and this Contractor shall remove same which are not removed by the telephone companies. All related charges shall be paid by this contractor.

C. The Contractors bidding on this work shall be responsible to visit the project site and determine the existing conditions and shall include in their bid the total cost for this demolition work, and cartage as specified above.

D. Where demolition of existing walls or partitions, leave existing conduits protruding through floor slab and new walls will cover their exposure they shall have unused wiring removed, be saw cut off at floor, ground smooth with floor and filled with non-shrink grout. All circuits affected by the removal of these conduits shall be re-fed from overhead as specified hereinbefore.

E. Where demolition of the existing walker duct carpet flanges is indicated on drawings this contractor shall remove the existing access cover plate, ground collar down smooth with floor and install a new thicker cover plate to bring walker duct flush with the existing structural floor. New cover shall remain accessible for future access to the walker duct and shall be approved by the Architect prior to the installation of the final floor covering.

1.24 SCHEDULE

A. The Contractor shall submit, within 15 days after notice to proceed, a schedule of work and equipment delivery for this project and a list of all major subcontractors' electrical items with the manufacturer's name, suppliers name and estimated date of receipt of material.

B. It shall be the Contractor's and Equipment Supplier's responsibility to make themselves aware of the schedule and submit shop drawings accordingly in order to achieve receipt of material and equipment on a timely schedule to meet the building ready and project completion dates.

C. The Contractor shall immediately notify the Architect if any installation problems or delivery problems are anticipated which would impede installation or scheduled completion of this project.

D. Method Of Procedure:

1) Submit Method of Procedure for any interruption of service and/or connection to energized systems requiring special sequences, synchronization and/or protections. See Section 16011 for additional information. MOP shall be provided upon request from either the Architect/Engineer or the Owner.

1.25 SAFETY AND LOCKOUT/TAGOUT PROCEDURES

A. Safety of all personnel during work performed is the responsibility of the Contractor. Working on and around electrical equipment and circuits requires more than normal precautions. Obtain checklist for lockout and tagout of all energy driven equipment from Architect/Engineer prior to construction.

3.10 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise noted.

E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Right of Way: Give to piping systems installed at a required slope.

3.11 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 0.25-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

i. 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."

3.12 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

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SECTION 26 05 02 – WORK IN EXISTING FACILITIES

PART 1. GENERAL

1.1 SEQUENCE OF WORK

A. The following is the suggested sequence of work providing the Contractor with the intentions and desires of the Owner's relative to service, testing of the new system and equipment, and cutover preferences. The sequencing is suggested only, and in no way alleviates the Contractor from preparing a schedule of the necessary work for review by the Consultant specified in other sections.

B. The Contractor shall closely follow the phasing schedule outlined in the front end specifications and/or architectural sections.

1.2 VISIT TO SITE OF WORK

A. Visit site and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference shall be reported immediately to Owner/Consultant.

1.3 CONTRACTOR'S USE OF PREMISES

A. Confine operations at site to areas and limits permitted by law, ordinances, permits; Contract Documents and GENERAL CONDITIONS.

B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.

C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with Work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

D. Contractor shall pay for, or satisfactorily repair, all damages incident to their Work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this Contract.

PART 2. EXISTING FACILITY REQUIREMENTS

2.1 DEMOLITION OF EXISTING ELECTRICAL SYSTEMS

A. Demolish existing electrical work, including auxiliary systems, in areas of existing building shown reworked. Coordinate removal of electrical systems with Owner and Engineer.

B. In reworked areas, remove all electrical equipment; i.e.: Light fixtures, panelboards, switches, receptacles, auxiliary system devices, telephone outlets, etc.; unless otherwise noted. Remove existing branch circuits (conduit, wire, outlet boxes and supports) serving equipment to be removed. Abandon circuits concealed in concrete. Remove conductors from abandoned conduits. Leave existing branch circuits and feeders, which run through reworked areas and serve existing equipment to remain in service, continuous and uninterrupted. Repair, re-terminate, re-support, etc., any damaged circuits, feeders or supports.

C. Abandon outlets in existing masonry walls: Remove plaster frames, fill outlet box with grout and patch finish to match existing wall. Cut off abandoned conduits at wall where stubbed-out in furred ceiling space.

D. Cut off abandoned conduits concealed in slab one inch below top of base floor slab and patch slab or floor to match existing.

2.2 CONTINUITY OF SERVICE/METHOD OF PROCEDURE

A. Provide continuous, uninterrupted electrical service to existing outlets, apparatus, and equipment in existing building. Provide necessary temporary wiring installed in safe, acceptable manner to equipment and outlets as required.

B. Electrical work during service interruptions will occur after normal working hours between 5:00 PM and 6:00 AM. Include premium time (overtime) labor in bid to perform this work. Work with the school to figure out best time.

C. The contractor shall trace all circuits including branches that are affected by the MOP.

2.3 WELDING AND CUTTING

A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations. Before proceeding with any electric or gas welding or cutting or soldering work in or adjacent to the existing building the Contractor shall obtain a permit from either the Engineer or Owner. The permit shall be issued by its authorized supervisor or representative certifying compliance with conditions set out in the permit pertaining to welding and cutting operations.

2.4 SALVAGE

A. Electrical equipment, wiring, etc., removed and not required to be part of new electrical installation is classed as salvage.

B. The Contractor shall submit a list of salvageable equipment and/or parts identified below that are to be removed. The list shall be given to facilities for owner to have the first right of refusal.

END OF SECTION

SECTION 26 05 19 – LOW VOLTAGE ELECTRICAL CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. For conductors #8 AWG and smaller, splice and tap connectors shall be spring connectors with molded vinyl caps. For conductors #6 AWG and larger, splice and tap connectors shall be split-bolt or compression type installed with hydraulic tool of proper capacity as recommended by the manufacturer for the size of conductor on which the connector is used.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

F. Induction motors are to be terminated with bolted pressure connections and insulated with varnished cambric, then Scotch 130C rubber tape and covered with a minimum of three laps of scotch 33+ electrical tape.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

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. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex Co. or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Pipeline Seal and Insulator, Inc.
4. Metraflex.

C. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two (2) for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Sizes noted on drawings are for copper.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Use no conductors smaller than No. 12 gauge unless specifically called for or approved by Design Engineer. Size wire for 120 volt branch Circuits for 3% maximum voltage drop. Size feeder circuits for 2 percent maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5 percent maximum.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Wire in conduit shall be cross-linked polyethylene type XHHW.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits, below Slabs-on-Grade, and Underground: Type XHHW, cross-linked polyethylene.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: Type THHN-THWN, in raceway Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.

B. Neatly route, tie and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.

C. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

D. 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.

E. Provide factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90° bends, for pulls in conduits underground or under slabs on grade, and where indicated.

F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

H. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

I. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

J. 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.

K. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
2. Make circuit conductor splices with Buchanan B-Cap nylon insulated connectors or equivalent by Ideal or 3M.
3. Make fixture and device taps with Scotchlock self-stripping electrical tap connectors.
4. Terminate solid conductors at equipment terminal strips and other similar terminal point with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sta-Kon insulated terminals and connectors or equivalent by API/AMP Blackburn, Buchanan or Scotchlock.
5. Where a total of six or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks, provide mounting channel and see-thru covers. Equivalent terminal blocks by General Electric, Square D or Westinghouse.
6. Wrap conductor taps and connections requiring additional insulation with a minimum of three (3) overlapped layers of 3M Scotch vinyl plastic electrical tape No. 88 or equivalent.

L. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

M. No wiring or conduit shall be placed in the concrete slab.

N. All cables 24VDC and under shall be installed in cable tray or conduit. Any conductors operating above 24VDC to be in conduit.

3.4 FIELD QUALITY CONTROL

A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels.

B. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

C. Subsequent to wire and cable hookups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

D. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows: For conductors #8 and larger, provide a minimum of 10 wraps of color coded vinyl tape within 6” of conductor termination points or color coded insulation.

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. 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.

D. Cut sleeves to length for mounting flush with both wall surfaces.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide 0.25-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

H. 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."

I. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

J. 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.

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 according to Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment. Provide a grounding system as required by the National Electric Code (NEC) and local authorities.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 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, 0.25-inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1.625 inches wide and 0.0625-inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1.625 inches wide and 0.0625-inch thick.

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 steel 0.75-inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid or stranded 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 tinned-copper conductor, No. 3/0 AWG minimum. 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 (3) bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. 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 (exterior only) and (dimming 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. Metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. 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.
10. Connect system neutral ground and equipment ground system to common ground bus.

B. 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.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 0.25-inch by 2-inch by 12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with NEC. Provide each service disconnect enclosure with neutral disconnecting means which interconnect with insulated neutral and uninsulated equipment ground sub to establish system common ground point. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

3.3 INSTALLATION

A. 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.

B. 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 (3) 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. Rods shall be interconnected by a minimum 3/0 bare copper conductor brazed to each ground rod below grade.

C. 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.

D. 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 building 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.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

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, and at ground test wells.
    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. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29 – HANGER AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper B-Line, Inc.; a division of Cooper Industries.
   b. Thomas & Betts Corporation.
   c. Unistrut; Tyco International, Ltd.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. 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 and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. 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.
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
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.
    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) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Hilti Inc.
        3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        4) MKT Fastening, LLC.
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. Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box. Where plastic conduit is used, follow E/M’s recommended hangar spacing.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 0.25-inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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 single-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1.5-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, IMC 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 pounds.

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: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
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 by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

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 4 inches thick or as otherwise 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 "Cast-in-Place Concrete and Miscellaneous Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

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 in Division 09 painting Sections 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.

D. All conduit raceways and cable trays where exposed in finish space shall be painted to match attached surface or material.

END OF SECTION

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 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.

C. Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: Hot dipped galvanized with clear lacquer finish complying with ANSI C80.1.

B. PVC coated rigid metal conduit complying with ANSI C80.1, UL 6 and NEMA RN-1. Match existing used at for OR Isolation Panel circuits.

C. EMT: Thin wall with electro-galvanized and clear lacquer finish complying with ANSI C80.3.

D. 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.
2. Fittings for EMT: Steel, compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

A. ENT: NEMA TC 13.

B. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, as indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Flanged-and-gasketed type.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Butler Manufacturing Company; Walker Division.
b. Hubbell Incorporated; Wiring Device-Kellems Division.
c. Lamson & Sessions; Carlon Electrical Products.
d. Panduit Corp.
e. Walker Systems, Inc.; Wiremold Company (The).
f. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.

G. 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. 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. Includes raceways in the following locations:

a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
b. Mechanical rooms.
c. Electrical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: Rigid steel conduit.
6. Raceways for Optical Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

B. EMT Conduit shall be provided for the following application where cable is installed in occupied area without ceiling or cable tray, and in walls to above ceiling:

1. Data and telephone wiring
2. Intercom
3. Fire Alarm
4. Security System
5. Cable TV
6. DDC control wiring

C. Minimum Raceway Size: 0.75-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. Setscrew fittings shall not be allowed.

E. Short runs of flexible conduit may be used where permitted by code. Lengths greater than 6 feet require prior approval by engineer.

F. Plastic conduit shall not be used above grade for any purpose.

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 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation. Provide insulated throat fittings prior to conductor installation. Failure to do so may result in re-pulling of wiring.

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 three 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. Install exposed conduit parallel or at right angles to building lines. Install all conduit in neat, workman like manner.

H. Make conduit connection to motors and equipment on resilient mounts with liquid-tight flexible conduit.

I. Where conduits cross building expansion joints, provide expansion fittings as required.

J. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to rigid steel conduit, before rising above the floor.

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. All below grade non-metallic conduit shall be provided with tracer wire.

N. Raceways for Optical Fiber and Communications Cable: Install as follows:

1. 0.75-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 (2) 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.

O. 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.

P. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, 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 or LFNC in damp or wet locations not subject to severe physical damage.

Q. 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.

R. Set metal floor boxes level and flush with finished floor surface.

3.3 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."

END OF SECTION

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS 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. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and boxes.
3. Manholes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

B. HDPE: High Density Polypropylene

1.4 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, boxes, and other utility structures.
4. Warning tape.
5. Warning planks.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design and manhole frame support rings.
4. Ladder details.
5. Grounding details.
6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

E. Product Certificates: For concrete and steel used in precast concrete [manholes] [and] [handholes], as required by ASTM C 858.

F. Qualification Data: For professional engineer and testing agency.

G. Source quality-control test reports.

H. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

1.9 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.

B. Furnish cable-support stanchions, arms, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NON-METALLIC HDPE CONDUIT

A. Solid Wall High Density polyethylene (HDPE) conduit is based on ASTM F 2160 and shall be used primarily for underground applications as conduit, innerduct, direct buried or concrete encased applications. The HDPE shall meet or exceed the properties listed in ASTM D-3350 for minimum cell classification of 335480 C or E (color with UV stabilizer).

1. Conduit shall be UL labeled and confirm to NEC 353 and be manufactured in accordance with UL 651A.
2. Conduit shall be SDR-11 in non-traffic areas and Schedule 40 in areas below traffic.
3. Lubrication shall be allowed for interior to reduce friction. Consult manufacturer for allowable types.
4. Use pull-strings where shown or required on the plans.
5. Acceptable HDPE manufacturers:

    a. Dura-line
    b. Carlon
    c. Others by approval

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

D. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

E. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

F. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.

    a. Color: Red dye added to concrete during batching.
    b. Mark each plank with "ELECTRIC" in 2-inch-high, 3/8-inch-deep letters.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

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. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

C. Comply with ASTM C 858 for design and manufacturing processes.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering "ELECTRIC." And "TELEPHONE." Or as indicated for each service.
7. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    a. Extension shall provide increased depth of 12 inches.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
    a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

11. Handholes [12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray
2. Configuration: Units shall be designed for flush burial and have [open] [closed] [integral closed] bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC." OR "TELEPHONE" or as indicated for each service.
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] or a comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. NewBasis.
    e. <Insert manufacturer's name.>

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] or a comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Christy Concrete Products.
    d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. Carson Industries LLC.
    b. Christy Concrete Products.
    c. Nordic Fiberglass, Inc.

E. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be polymer concrete.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] or a comparable product by one of the following:

    a. Carson Industries LLC.
    b. Nordic Fiberglass, Inc.
    c. PenCell Plastics.

2.6 PRECAST MANHOLES

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. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

C. Comply with ASTM C 858[, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article] and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

    a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

D. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

E. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.7 CAST-IN-PLACE MANHOLES

A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Materials: Comply with ASTM C 858 and with Division 03 Section "Cast-in-Place Concrete."

C. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

2.8 UTILITY STRUCTURE ACCESSORIES

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. Bilco Company (The).
2. Campbell Foundry Company.
3. Carder Concrete Products.
4. Christy Concrete Products.
5. East Jordan Iron Works, Inc.
6. Elmhurst-Chicago Stone Co.
7. McKinley Iron Works, Inc.
8. Neenah Foundry Company.
9. NewBasis.
10. Oldcastle Precast Group.
11. Osburn Associates, Inc.
12. Pennsylvania Insert Corporation.
13. Riverton Concrete Products; a division of Cretex Companies, Inc..
14. Strongwell Corporation; Lenoir City Division.
15. Underground Devices, Inc.
16. Utility Concrete Products, LLC.
17. Utility Vault Co.
18. Wausau Tile, Inc.

C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B] with milled cover-to-frame bearing surfaces; diameter, 26 inches.

   a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.

   a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
   b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
   c. Legend: "SIGNAL" for communications, data, and telephone duct systems.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.

   a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

D. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-diameter eye, and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

F. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch-diameter eye, rated 2500-lbf minimum tension.

G. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch-diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

J. Cable Rack Assembly: Steel, hot-rolled, galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.
2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

L. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

M. Fixed Manhole Ladders: Arranged for attachment to wall of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin

N. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.9 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION (OUTSIDE THE BUILDING)

A. Service Entrance Ducts for Electrical Cables Over 600 V: RNC, NEMA Type [EPC-80] [EB-20]-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Secondary Service Entrance Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type [EPC-80] [EB-20]-PVC, in concrete-encased duct bank, unless otherwise indicated.

C. Ducts for Electrical Feeders 600 V and Less: HDPE, in direct-buried duct bank, unless otherwise indicated.

D. Ducts for Electrical Branch Circuits: HDPE, in direct-buried duct bank, unless otherwise indicated.

E. Service Entrance Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

F. .Branch Underground Ducts for Telephone, Communications, or Data Utility Service Cables: HDPE direct buried.

3.2 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Manholes: Precast concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf-test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than [4] [5] spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. 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.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For 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.

11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03 Section "Cast-in-Place Concrete."

B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below the frost line, <Insert depth of frost line below grade at Project site> below grade.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 Section "[Elastomeric Sheet Waterproofing] [Thermoplastic Sheet Waterproofing]." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 07 Section "Bituminous Dampproofing." After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, [and insulators, as required for installation and support of cables and conductors and as indicated.

I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

J. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

K. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 36” below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, non-deliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth

1. Concrete: 4000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 0.25-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. 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."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 0.625-inch thick for signs up to 20 sq. inches and 0.125-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.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 0.375-inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 0.375-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 0.375-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 0.375-inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.9 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. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

C. Junction Boxes: All junction boxes containing emergency feeder branch circuits shall be painted with colors indicated below. ALL sides of the junction box shall be painted to allow easy identification, including cover.
1. Orange – Critical Branch
2. Red Stripe – Life Safety Branch
3. Yellow – Equipment Branch

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Control/Instrumentation Wire:

1)	120VAC control signal:	Red
2)	120VAC line power:	Black
3)	120VAC line neutral:	White
4)	Grounds:	Green
5)	DC ungrounded Control Circuits:	Blue
6)	DC grounded Control Circuits:	White with Blue stripe
7)	Analog Pair:	Black/White or Black/Red
8)	Instrument signal Cable Jacket:	Black or Gray
9)	RTD V+ (device):	Black
10)	RTD V- (device):	White
11)	RTD compensation (device):	Red
12)	Externally powered:	Orange
13)	Intrinsically Safe:	Light Blue

e. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

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.

I. 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.

J. 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:

TYPE 1: Laminated phenolic plastic with black Gothic-condensed lettering by Seaton or Wilco.

TYPE 2: Self-sticking 0.5-inch wide flexible nylon tape with high gloss surface and typed smear-proof, chemical/solvent resistant lettering by Brady or Dymo.

TYPE 3: Self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1 - 1964 and OSHA 19.0.144iii(2) Specifications, by Brady or as approved.

TYPE 4: Self-sticking flexible vinyl with oil resistant adhesive for -20 degrees to 300 degrees F. temperatures by Brady or as approved.

a. Provide switchboards with Type 1 signs 2.5 inches x 12 inches indicating switchboards designation and electrical characteristics as noted on drawings. Provide switchboards sections operating at different voltages with Type I sign 2 inches by 8 inches indicating electrical characteristics of section. Provide each switchboard device with Type 1 sign 1.25 inches by 5 inches indicating load served.
b. Provide distribution panelboards with Type 1 signs 2 inches by 8 inches indicating panel designation and electrical characteristics. Provide branch devices with Type 1 sign 1 inch by 4 inches indicating load served.
c. Provide lighting and power panelboards with Type 1 sign 1.25 inches by 6 inches indicating panel designation, electrical characteristics, and source of power. Source of power indication shall indicate source panel designation and switch or breaker number. Mount inside of panel door on circuit breaker trim flange just below breakers.
d. Provide disconnect switches, time switches, lighting contactors, motor starters and controllers with Type 1 sign 1.25 inches by 6 inches indicating equipment served, electrical characteristics, and source of power,

e. Provide feeders and branch circuit home runs with Type 4 wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.

f. Provide Type 2 tape at feeder terminal lugs to switchboards and panelboards. Tape shall indicate conduit size, conductor type and AWG size. Tape shall be located to be easily read with conductors installed.

K. Panelboard Labeling:

1. Contractor shall provide new circuit directories at all panelboards in which a load alteration has occurred. Labels shall be typed, posted to the inside of the panelboard door and indicate all new and existing loads. Existing loads that have been removed shall be labeled as "spare". Existing loads that have been altered (reused or added) shall be indicate the (new) load served on the directory.

END OF SECTION

SECTION 26 09 23 – LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Wall box dimmers.
2. Indoor occupancy sensors.
3. Outdoor motion sensors.
4. Lighting contactors.
5. Emergency shunt relay.

B. See Division 26 Section "Wiring Devices" for wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 LED dimming drivers / dimmers

A. LED dimming driver.
1. 3-Wire (Line Voltage Controlled) Dimming Drivers
2. Digital (Low Voltage Controlled) Dimming Drivers

2.2 Wall box dimmers

A. Acceptable Manufacturer: Lutron Electronics Co., Inc.

B. Leviton

C. Substitutions: Under provisions of Division 012500.
1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.
2. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
3. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.
4. Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

D. GENERAL
1. Ten-year operational life while operating at maximum case temperature
2. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairmentper IEC 801-2.
3. Electrolytic capacitors to operate at least 20 degrees C below the capacitor’s maximum temperature rating when the driver is under fully-loaded conditions and under maximum case temperature.
4. Maximum inrush current of 2 amperes for 120V and 277V drivers.
5. Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

6. Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.
7. Inaudible in a 27 dBA ambient.
8. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
9. Total Harmonic Distortion less than [20] percent and meet ANSI C82.11 maximum allowable THD requirements
10. Drivers to track evenly across:
    a. Multiple fixtures.
    b. All light levels.
11. Constant current drivers must provide models to:
    a. Support from 200mA to 2.1Amps (in 10mA steps) to ensure a compatible driver exists
    b. Support LED arrays up to 40W
12. Constant voltage drivers must provide models to:
    a. Support from 10Volts to 40Volts (in 0.5V steps) to ensure a compatible driver exists
    b. Support LED arrays up to 40W
13. Configuration tool must be available to optimize the following for LED fixtures:
    a. Light level
    b. Efficacy
    c. Thermal performance
14. Driver must be capable of operating from a supply voltage of 120 through 277VAC at 60Hz for EcoSystem and 3-wire models.

E. 3-Wire Control
1. Continuous dimming from 100 percent to 1 percent relative light output.
2. Provide integral fault protection to prevent driver failure in the event of an input mis-wire.

F. EcoSystem Digitally addressable Control
1. Continuous dimming from 100 percent to 1 percent relative light output
2. Ability to operate with installed or specified building control system
3. Lights automatically return to the setting prior to power interruption.
4. Each driver responds independently to:
    a. Up to 32 occupant sensors.
    b. Up to 16 daylight sensors.
5. Responds to digital load shed command.
    a. Sets high end trim.
    b. Automatically scales light output proportional to load shed command.
        1) Example: If light output is at 30 percent and a load shed command of 10 percent is received, the driver automatically sets the maximum light output at 90 percent (of the 30 percent light level) and lowers current light output by 3 percent to 27 percent.

G. forward phase Control (neutral wire required)
1. Continuous dimming from 100 percent to 1 percent relative light output

2.3 SOURCE QUALITY CONTROL

A. Perform full-function testing on 100 percent of all drivers at the factory.

2.4 REMOTE CONTROL LIGHTING CONTACTORS

A. Lighting contactor shall be ASCO 917, Catalog Number 91762031-120 volt-60 Hz, or listed equivalent manufacturer.

B. The remote control lighting contactor shall be electrically operated by a dual-acting, single-solenoid mechanism that is inherently interlocked and mechanically held in both the open and closed positions. The main contacts shall be power driven in both directions. Positive locking of contact positions shall no be dependent on gravity, hooks, latches or semi-permanent magnets.

C. The remote control lighting contactor shall be capable of operation in any position. Provisions shall be incorporated for manual operation during inspection and maintenance.

D. The remote control lighting contactor shall be Underwriters' Laboratories listed under UL 508. Main contacts shall be double-break, continuous-duty rated 20 amperes to 600 volts AC, 60 Hz (30 amperes to 600 volts AC, 60 Hz, for general-purpose loads), and be marked for ballast lighting

(electric discharge lamps), tungsten and general-purpose loads. Lighting contactors requiring derating when used in an enclosure or with tungsten lamp loads shall not be acceptable.

E. The remote control lighting contactor shall be provided with clamp-type, self-rising terminal plates for solderless connection of line, load and control conductors. Terminals shall accept a wire range of #18 AWG to #10 AWG CU.

F. The number of poles, up to a maximum of 12, on a single remote control lighting contactor, shall be provided as indicated on the plans.

G. The remote control lighting contactor shall be UL listed for the following short-circuit withstand current ratings when coordinated with a UL-listed molded case circuit breaker rated 30 amperes:
   1. 22,000 amps rms symmetrical, 250 volts, 60 Hz

H. The operating coil and main contacts shall be replaceable from the front without major disassembly and visual indication shall be provided for each main contact.

I. Provisions shall be included to permit remote pilot lamp-type visual indications without the necessity for auxiliary contacts or additional wiring.

J. Each remote control lighting contactor shall be furnished with an owner's manual providing installation and operating instructions.

K. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

L. Manufacturers: Subject to compliance with requirements, provide lighting control equipment of one of the following (for each type and rating of equipment):
   1. Hubbell, Inc.
   2. Lutron Corporation.
   3. Square D Co.
   4. Allen Bradley.
   5. Siemens
   6. Cutler Hammer

2.5 MOTION DETECTORS

A. All detectors shall be dual technology.

B. Provide power packs where required for low voltage sensors (up to 3).

C. Wall devices shall be line voltage with override, and be dual technology type.

D. Motion detector shall scan a field vision of 110 degrees minimum.

E. Sensors shall detect movement up to a minimum of 80 feet away.

F. Motion detector shall be mounted on a swivel base for adjustment of sensing range.

G. Motion detector shall have a capacity of sensor switching up to a minimum of 500 watts.

H. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

I. Manufacturers: Subject to compliance with requirements, provide lighting control equipment of one of the following (for each type and rating of equipment):
   1. Hubbell, Inc.
   2. Lutron Corporation.
   3. Square D Co.
   4. Allen Bradley.
   5. Siemens
   6. Cutler Hammer
   7. Wattstopper.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 0.5-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.

3.2 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.3 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.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. 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 bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Panelboard schedules for installation in panelboards.

E. 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 NEMA PB 1.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets dead front design.

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 with gasketed door and lock assembly with all locks keyed alike.
c. Other 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. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses: Tin-plated hard-drawn copper, 98 percent conductivity.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated hard-drawn copper, 98 percent conductivity.
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.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

1. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only with field convertible top or bottom feeds for incoming feed.

D. Minimum short circuit current rating of 22,000 in rms symmetrical amperes unless otherwise indicated.

E. Provide one continuous plated copper bus bar per phase. Provide solidly bonded copper equipment bus bar and additional isolated/insulated ground bar as specified.

F. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating 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. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. 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. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip: (Voltage as prepared by Siemens) trip coil energized from separate circuit, set to trip at percent of rated voltage - As required by Siemens.
    f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in [off] position.
    g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. 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.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 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 and incorporating 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."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. 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.

D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 RECEPTACLES

A. Provide receptacles with automatic self-grounding clip, back and side wired with clamp-type terminals and additional features. Comply with UL 498 and NEMA WD 1. Receptacles shall be 120V, 20A, heavy duty grade.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell 5262 series or equal

2.3 INDUSTRIAL HEAVY DUTY RECEPTACLES

A. Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Provide features indicated.

2.4 GFCI RECEPTACLES

A. Provide "feed-thru" type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles, test button, LED indicator lamp, and reset button arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4" deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3, heavy duty industrial grade.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 2221PL for 120 V and 277 V.
   b. Hubbell; HPL1221PL for 120 V and 277 V.
   c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
   d. Pass & Seymour; PS20AC1-PLR for 120 V.

3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 1995.
   b. Hubbell; HBL1557.
   c. Leviton; 1257.
   d. Pass & Seymour; 1251.

2.6 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable slider, 5 A.
2. Three-speed adjustable slider, 1.5 A.

2.7 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 3560-6.
   b. Leviton; 40649.

3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 3562.
b. Leviton; 40595.

3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one (1) Type F coaxial cable connector.

2.8 WALL PLATES

A. Single and combination, of types, sizes, and with gangin and cutouts as required. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide white color wall plates except in clean room, process areas or unfinished areas as indicated below. Provide wall plates with engraved legend or micarta label indicating panel and circuit number. Provide plates possessing the following additional construction features in clean rooms and process areas:

1. Clean Room

a. Receptacle covers shall be specification grade grey polycarbonate, single lid covers with stainless steel hinges, gasket and stainless steel screws and of the in use type.

b. Switch covers shall be 0.04” thick, type 304 satin finished stainless steel with flexible silicone bubble for switch actuation, with gasket and stainless steel screws. Pass & Seymour 4516 or equal.

2. Mechanical Room

a. Wall plates shall be type 430 satin finish stainless steel

3. Unfinished Room

a. Wall plates shall be galvanized steel.

2.9 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

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.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

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.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. 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.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 FIELD QUALITY CONTROL

A. 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.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 114 to 126 V.
2. Percent Voltage Drop under 15-A Load: A value of higher than 5% 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, and retest as specified above.

END OF SECTION

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nonfusible switches.
   2. Receptacle switches.
   3. Shunt trip switches.
   4. Molded-case circuit breakers (MCCBs).
   5. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI7.

   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

   1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

D. Operation and maintenance data.

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 NFPA 70.

PART 2 - PRODUCTS

2.1 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three (3) padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-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.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider 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. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: 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. Auxiliary Contacts: One (1) SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Alarm Switch: One (1) NO contact that operates only when circuit breaker has tripped.

2.3 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 or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 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 and Seismic 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.

3.2 IDENTIFICATION

A. Comply with requirements 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 metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. 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.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. 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.

END OF SECTION

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SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

C. Field quality-control test reports.

1.3 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for each lighting fixture is based on the product named in the schedule. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified in the schedule.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

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.

G. 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.
4. Laminated Silver Metallized Film: 90 percent.

H. Plastic Diffusers, Covers, 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 different thickness is indicated.
   b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 BALLASTS

A. Electronic Ballasts for Linear Fluorescent Lamps: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.85 or higher.
7. Power Factor: 0.95 or higher.

B. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying 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: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, 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 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

C. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 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. Night-Light Connection: Operate one fluorescent lamp continuously (if specifically indicated on drawing only).
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 rated for 90 minute operation minimum.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.4 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type rated for automatic 90 minute operation minimum.
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.

2.5 LAMPS

A. LED – LM80 rated fixtures only, 4000 K color temperature, CRI =80 minimum

B. Low-Mercury Fluorescent Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

C. T5 Rapid-Start low-mercury Fluorescent Lamps: Rated 28 W maximum, nominal length 48 inches, 2800 initial lumens (minimum), CRI 78 (minimum), color temperature 3500 K, and average rated life 24,000 hours, unless otherwise indicated.

D. T5 Rapid-Start low-mercury Fluorescent Lamps: Rated 14 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 78 (minimum), color temperature 3500 K, and average rated life of 24,000 hours, unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts,]unless otherwise indicated.

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).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 0.5-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two (2), 0.5-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 gauge.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

F. Rod Hangers: 0.1875-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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture. Contractor shall coordinate fixture mounting with architectural ceiling type to verify compatibility.

B. Comply with NFPA 70 and NEC section 410 for minimum fixture supports.

C. 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.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

F. Hand indirect light fixture by use of aircraft cable unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 26 53 00 – EMERGENCY LIGHTING FIXTURES

PART 1. GENERAL

1.1 INCLUDES

A. This Section includes emergency light sets, exit fixtures with integral emergency battery backup, and emergency fluorescent fixture power supplies with integral battery backup.

B. Related Sections: The following Section contain requirements that relate to this Section:

1) Division 26 Section "Interior Lighting Fixtures" for regular fixtures that may be connected to emergency circuits to provide emergency lighting.

1.2 SUBMITTALS

A. General:

1) Submittals shall be made on all items in this section and shall be in accordance with the General Conditions.

B. Product Data: Submit manufacturer's technical product data, independent testing lab photometric data, including fixture specifications and installation instructions, for each type of emergency unit required. Include data substantiating that materials comply with requirements.

C. Maintenance Data: Submit maintenance data and parts lists for each type of emergency unit installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of the General Conditions of this Specification.

D. Samples of specific individual products for approval where indicated.

1.3 PREREQUISITE CONDITIONS

A. The General Conditions, Supplemental General Conditions and Special Conditions are part of this contract and requirements set forth in those sections apply to all work in this division of the specifications.

PART 2. PRODUCTS

2.1 EMERGENCY LIGHTING FIXTURES

A. Quality Assurance

1) Manufacturer's Qualifications: Firms regularly engaged in manufacture of interior lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years. All units specified in this section of the specifications hereinafter shall be furnished with not less than a five (5) year prorated warranty and not less than one year full replacement.

2) Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with interior lighting fixture work similar to that required for this project.

3) Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

4) UL Compliance: Emergency lighting fixtures shall be UL listed and labeled.

5) NFPA Compliance: Comply with applicable requirements of NFPA 101, "Life Safety Code."

6) Local Code Compliance: Comply with applicable local codes and regulations for emergency lighting and exit signage including, but not limited to, colors and letter heights for exit signs.

B. Deliver products in factory containers; store in clean, dry space in original container. Protect products from fumes and construction traffic.

C. Furnish stock of replacement lamps amounting to 15 percent (but not less than one lamp in each case) of each type and size lamp used in each type unit.

D. The following features apply to designer series type emergency light sets:

1) Self-contained emergency lighting units with style, shape, and trim as indicated.

2) Battery: Sealed, maintenance-free, lead-acid type with 10 year nominal life.

3) Charger: Minimum two-rate, fully automatic, solid-state type, with sealed transfer relay.

4) Operation: Relay turns lamp on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamp operates for duration of outage, up to 1.5 hours. Lamp automatically disconnected from battery of voltage approaches deep-discharge level. When normal voltage is restored, battery is automatically recharged within 16 hours and then floated on trickle charge.

5) Control panel contains low-voltage disconnect switch, LED indicator light, voltmeter, test switch, and concealed terminals for remote lamp head connection.

6) Cylinder Style: Lamp, battery, charger, and relay mounted in cylindrical housing. Unit shall have the following features:

(a) Cylinder shall be mounted on metal base with locking swivel joint providing 180 deg, 2-way lamp aiming.

(b) Shallow profile base shall mount on wall or ceiling.

(c) Finish: Matte white for exposed parts, or as selected by the Architect.

7) Recessed or Semi-recessed Type with Lens: Wall or ceiling mounted with the following features:

(a) Lamps and reflectors as indicated.

(b) Finish: Matte white for exposed parts, or as selected by the Architect.

(c) Trim at wall or ceiling conceals fixture opening.

(d) Lens: 0.125-inch thick prismatic acrylic.

8) Surface-Mounted Type with Lens: Wall or ceiling-mounted unit with the following features:

(a) Lamps and reflectors as indicated.

(b) Finish: Matte white for exposed parts or as selected by the Architect.

(c) Lens: 0.125-inch thick prismatic acrylic.

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

(a) Chloride Systems

(b) Sure-Lites

(c) Infinity

(d) Dual-lite

(e) Highlites Inc.

(f) Hubbell, Inc.

(g) Lithonia Lighting

(h) Thomas Industries, Inc

(i) Yorklite Div. Widelite Inc.

E. The following features apply to Die Cast Self-contained, a.c. battery-illuminated exit sign unit, universal mounting with downlight.

1) Lamps: Manufacturer's standard, furnished with unit.

2) Style, shape, trim, material, finish, and arrangement of housing as indicated.

3) Faceplate: Aluminum stencil face with red high-impact, UL 94 V-O rated, plastic letters and snap out arrows.

4) Mounting provisions shall suit individual installation conditions.

5) Battery: Sealed, maintenance-free, lead-acid type, with 10-year nominal life.

6) Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.

7) Finish: Matte white for exposed parts, or as selected by the Architect.

8) Operation: Sign is illuminated by a.c. powered lamps under normal conditions. Relay turns emergency lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. Lamps automatically disconnect from battery when voltage approaches deep-discharge value. When normal voltage is restored, a.c. powered lamps are relighted and d.c. lamps are switched off. Battery is automatically recharged within 16 hours and maintained on trickle charge.

9) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:

(a) Devine Design, Inc.

(b) Halo Lighting

(c) Highlites Inc.

(d) Hubbell, Inc.

(e) Lithonia Lighting

(f) Thomas Industries, Inc.

F. The following features apply to internal type inverter units for designated fluorescent fixtures, provided under Division 26 Section "Interior Lighting" provide internal self-contained, modular, battery-inverter unit, factory mounted within the fixture body.

1) Arrange unit with test switch and LED indicator light, visible and accessible without opening fixture or entering ceiling space.

2) Battery: Sealed, maintenance-free, nickel-cadmium type, with normal 10-year life, minimum.

3) Charger: Fully automatic, solid-state, constant-current type.

4) Operation: Relay turns two lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. When normal voltage is restored, battery is automatically recharged within 12 hours. Lamp lumen shall not be less than 900 lumens throughout specified operation period.

5) External Type: For designated fluorescent fixtures, provided under Division 26 Section "Interior Lighting" provide external self-contained, modular, battery-inverter unit.

6) Arrange unit with test switch and LED indicator light, visible and accessible without entering ceiling space.

7) Battery: Sealed, maintenance-free, nickel-cadmium type, with normal 10-year life, minimum.

8) Charger: Fully automatic, solid-state, constant-current type.

9) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:

10) Manufacturers: Subject to compliance with requirements, provide products by the following:

(a) Bodine Inc.

(b) Chloride Systems

(c) Dual-Lite, Inc.

(d) Highlites Inc.

(e) Hubbell, Inc.

(f) Siltron Illumination, Inc.

2.2 INSTALLATION

A. Setting and Securing: Set units plumb, square, and level with ceiling and walls and secure in accordance with manufacturer's written instructions and approved shop drawings. Conform to the requirements of NFPA 70.

B. Mounting heights specified or indicated are to bottom of fixture for suspended or ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures.

C. Recessed and semi-recessed fixtures may be supported from suspended ceiling support system if the ceiling system support rods or wires are installed at a minimum of four rods or wires per fixture and located not more than 6 inches from fixture corners. For fixtures smaller than the ceiling grid, install a minimum of four rods or wires per fixture and locate at corner of the ceiling grid in which the fixture is located. Do not support fixtures by ceiling acoustical panels. Where fixtures smaller than the ceiling grid are indicated to be centered in the acoustical panel, support fixtures independently with at least two 3/4-inch metal channels spanning and secured to the ceiling tees. Rods or wires for lighting fixture supports shall conform to the requirements of Section "Acoustical Treatment." Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.

D. Lamping and Connection: Lamp units in accordance with manufacturer's instructions. Make external wiring connections required for proper functioning.

E. Coordinate with other electrical installations as appropriate for proper installation of emergency lighting fixtures.

F. Clean emergency units light set upon completion of installation.

G. Adjust aimable fixtures to provide light intensities in egress paths.

H. Ground non-current-carrying parts of equipment; where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

I. Tighten grounding connections to comply with tightening torques specified in UL Standard 486A.

PART 3. EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests: After emergency lighting units have been installed and building circuits have been energized with normal power source, apply and interrupt electrical energy to demonstrate proper operation. Remove and replace malfunctioning units with new units and proceed with retesting. Give the Architect advance notice of dates and times for all field tests. Provide instruments as required to make positive observation of test results. Include the following in tests:

1) Duration of supply

2) Low battery voltage shutdown

3) Normal transfer to battery source and re-transfer to normal

4) Low supply voltage transfer

B. Insulation Resistance Test: Perform as specified in Division 26 Section "Low Voltage Electrical Power Conductors and Cables" both before and after connection of fixtures and equipment.

C. Electrical Continuity Tests: Perform as specified in Division 26 Section "Low Voltage Electrical Power Conductors and Cables".

D. Lamp Replacement: Prior to tests, install new lamps in emergency lighting units. After testing, place malfunctioning lamps.

END OF SECTION

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS

PART 1. GENERAL

1.1 INCLUDES

A. The extent of electrical grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. The type of electrical grounding and bonding work specified in this section includes the following:

1. Solidly grounded systems
2. Application of electrical grounding and bonding work in this section includes the following:

a. Exposed metal piping
b. Electrical power systems
c. Grounding electrodes
d. Raceways
e. Enclosures
f. Equipment

1.2 SUBMITTALS

A. General:

1. Submittals shall be made on all items in this section and shall be in accordance with the General Conditions.

B. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of grounding system required. Include data substantiating that materials comply with requirements.

C. Submit wiring diagrams for electrical grounding and bonding work which indicates layout of ground rings, location of system grounding electrode connections, routing of grounding electrode conductors, also include diagrams for circuits and equipment grounding connections.

D. Submit maintenance data and parts lists for each type of grounding system installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of the General Conditions of this Specification.

E. Submit product data for the following:

1. TMGB busbar
2. TGB busbar
3. Equipment rack busbars
4. Two hole and one hole lugs
5. No. 3/0 AWG and No. 6 AWG conductors

1.3 REFERENCES

A. ANSI/TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

B. All work and materials shall comply with the latest rules, codes and regulations, including but not limited to the following:

1. Occupational Safety and Health Act Standards (OSHA)
2. NFPA 70 - National Electrical Code (NEC)

3. ANSI/IEEE C-2 National Electrical Safety Code
4. All other applicable Federal, State, and local laws and regulations.

C. NFPA 70, Article 250 - Grounding

D. IEEE Standard 142 (Green Book) Recommended Practice for Grounding of Industrial and Commercial Power System.

E. IEEE Standard 1100 Power and Grounding Sensitive Electronic Equipment.

1.4 BONDING & GROUNDING INFRASTRUCTURE

A. IC (Interconnecting Bonding Conductor) (referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications): The copper conductor that bonds the TMGB to the service equipment (power) ground.

B. TMGB (Telecommunications Main Grounding Busbar): A copper ground reference busbar, typically installed in the entrance facility or entrance room, and is bonded to the service equipment (power) ground by the Interconnecting Bonding Conductor.

C. TGB (Telecommunications Grounding Busbar): A copper ground reference busbar, typically installed in telecommunication closets (TC) and is bonded to the TMGB by the TBB. The TGB references metallic entities in the TC space to ground.

D. TBB (Telecommunications Bonding Backbone): An insulated copper conductor extending from the TMGB to each TGB.

E. EK (Equipment Bonding Conductor): An insulated copper conductor that bonds metallic items and equipment to the TMGB and TGB.

PART 2. PRODUCTS

2.1 MATERIALS

A. Refer to the General Conditions, Supplementary General Conditions, and Division-1 General Requirements.

1. Equipment Rack Busbars

a. Acceptable Manufactures: Newton Instrument Company (Figure 4028) 1/4" x 1" x 19" rack ground bar detail, for equipment rack applications.

2. Other Ground Reference Busbars

a. Acceptable Manufactures: Newton Instrument Company (Figure 3059) 1/4" x 1" x 12" insulated copper bar, for miscellaneous applications.

3. Bonding Conductors

a. All bonding conductors shall be insulated copper. Exception is use of flat, braided, aluminum ground straps utilized for bonding sections of aluminum cable tray.
b. Unless otherwise specified, size the conductors as required by NEC.
c. Unless otherwise specified, the TBB (Telecommunications Bonding Backbone) shall be insulated, copper, No. 3/0 AWG.
d. Unless otherwise specified, the EK (Equipment Bonding Conductor) shall be green-colored insulation, copper, No. 6 AWG.
e. Bonding Conductor Terminations

B. Acceptable Manufacturers: Thomas and Betts, ILSCO, or approved equal.

C. Acceptable materials:

1. Two hole compression lugs: Thomas and Betts, "Two Hole Lugs Long Barrel Type" color code blue (example catalogue No. 54816BE), high conductivity wrought copper, electro tin plated, or approved equal.
2. One hole compression lugs: Thomas and Betts, "Long Barrel One Hole Lugs" color code blue (example catalogue No. 54905BE), high conductivity wrought copper, electro tin plated, or approved equal.

2.2 GENERAL GROUNDING

A. Manufacturers of grounding and bonding products and equipment shall be firms regularly engaged in manufacture of these devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five years.

B. Material and installation shall comply with NEC requirements as applicable to construction and installation of electrical grounding equipment and systems.

C. Material and installation shall comply with National Electrical Contractors Association's "Standard of Installation" pertaining to the installation, grounding and bonding of electrical systems, circuits and equipment.

D. The Contractor shall provide electrical components which are UL-listed and labeled for each particular installation.

E. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/conductors/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete and operational installation. Where more than one type component product meets indicated requirements, selection is Installer's Code-compliant option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

F. Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

G. All conduit systems, boxes, electrical equipment enclosures, motor frames, etc., shall be grounded in accordance with the requirements of the National Electrical Code, local authorities and as specified herein.

H. All grounding wires shall be copper and shall be sized in accordance with the latest edition of N.E.C.

I. All outlet boxes and junction boxes, disconnects, etc. shall be grounded. The ground wire terminal of each device shall be connected to the grounding conductor. All enclosures for electrical distribution and controls, all metal equipment supports for electrical controls and all similar items shall be connected to the grounding system.

J. All cable lugs for terminating grounding conductors number 6 AWG and larger, and as called for on drawings, shall be two hole hydraulic crimp compression type lugs connected to cable with a hydraulic compression tool. Each lug shall be connected to grounding bar or termination with two bolts plus "Belleville" type washers each side and nuts.

2.3 ELECTRICAL SYSTEM AND EQUIPMENT GROUNDING

A. All products shall be UL listed and labeled.

B. Ground conductors shall be 98% conductivity copper, either tinned bare or with green THWN-2 insulation. Other conductor requirements shall be the same as described for low voltage, 600 volt conductors.

C. Ground Connections:

1. Splices and Taps:

a. Thermoweld - utilize smokeless single shot exothermic connections for solid wire inside. Standard exothermic process may be used outside.

b. Compression - Solid long barrel copper, compressed with appropriate tool recommended by connector manufacturer. Use compression connections for stranded wire only.

2. Lugs:

a. Solid Wire - Use Thermoweld lug (smokeless inside) with two bolt tongue
b. Stranded Wire - Use solid long barrel copper sleeve, crimp type compression connector, with two bolt tongue, compressed with appropriate tool recommended by connector manufacturer.

3. Thoroughly clean connection surfaces prior to installation of clamps and/or lugs.
4. Where mechanical connections are unavailable, i.e. pipe clamps, et al, use bolted bronze mechanical connectors. Do not use clip-on connections.
5. Piping and conduit clamps: Use Burndy "GAR" or Penn Union type GPL, (no substitution unless accepted equivalent), size as required for piping
6. Seal connections between dissimilar metals (i.e.: bronze to steel), with "No-OXID-A" compound as manufactured by Dearborn Chemical Company.

2.4 INTERIOR EXPOSED GROUNDING CABLES

A. All exposed ground conductors shall be green in color.

B. All grounding conductors installed on cable tray or ladder rack shall be secured using the "KC Stitch" with approved cloth string.

C. Ground conductors connected to structure shall be connected with non-metallic approved fasteners.

D. Reference section 260519 for conductor types used for exposed ground wires. Interior telecommunications grounds shall not be ran in conduit and shall be fixed to the structure with approved non-metallic straps.

2.5 GROUNDING ELECTRODE AND REFERENCE GROUND SYSTEM

A. Ground Conductors

1. Interior (exposed): Bare stranded tinned copper or green insulated copper, size as shown.

B. Ground Connections

1. Buried and/or concealed inside building: Thermoweld process.
2. Interior Exposed wire connection requirements:

a. Solid Wire: Use smokeless thermolwelded connections for solid wire as shown.
b. Stranded Wire: Use Solid, long barrel copper connectors, compressed with appropriate tool recommended by connector manufacturer. Use compression connectors for stranded wire only.
c. Where exposed taps are made to stranded conductor interior ground rings, use wrought copper, split C tap copper compression taps or accepted equivalent.
d. Lugs: Solid wire to bus - Use Thermolwelded copper lug with two bolt tongue
e. Stranded wire to bus - Use long barrel copper sleeve, two-hole compression connector, with two bolt tongue
f. Piping Connections: Heavy cast bronze or copper equivalent to Burndy GAR or Penn Union GPL (no substitution)
g. Stranded wire to solid wire - use thermoweld connection

C. Preparation and Seal: Clean all connection surfaces and coat connection surfaces with "No-Oxide A" compound as manufactured by Dearborn Chemical Company.

D. Install all compression connectors with hydraulic compression tools recommended by manufacturer of connector to provide correct circumferential pressure. Provide embossing die code to make a visible indication that a connector has been adequately compressed on grounding conductor.

E. Ground Busses: 1/4" thick solid, hard drawn copper drilled as shown. Provide 2" ± stand off insulators, G.E. Benelex, (3/8" bolt size). Provide pre-drilled holes, to accommodate 3/8" bolts on 1" centers. See Details on drawing. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.

PART 3. EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.

C. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding. Submit torque actual torque values to the Architect for approval.

3.2 INSTALLATION

A. Bond ground conductors run in metal conduit to the conduit at all breaks and each end of run with full size conductor.

B. Coat all connections between dissimilar metals with "No-Oxid-A" compound as manufactured by Dearborn Chemical Company.

C. Bond all miscellaneous metal masses within 6' of the grounding conductor with #6 AWG copper conductor as shown.

D. In the Telecommunications Closets, Equipment Rooms, and Entrance Facilities provide all local bonding as specified on the drawings and in the specifications.

E. Ground electrical systems and equipment as required by code, utility, local ordinances, and requirements herein.

F. Cable connections and joints shall be provided per ANSI/TIA/EIA-607.

G. Bonding conductors should be continuous and routed in a direct route to point of termination.

H. All insulated ground bars must be isolated from the structural support by a 2" minimum separation, using manufacturer's recommended insulating stand-offs and hardware.

I. Clean ground bars prior to terminating conductors.

J. Label all telecommunications bonding conductors as close as possible to their termination point.

K. Bond all TGBs to the TMGB using conductor size specified.

L. Bond the following to the TGB when present:

1. Telecommunication panelboards: ACEG, if equipped, or its enclosure.
2. TGBs within the same space
3. TBBs terminated on the same floor to other TGBs
4. Metallic equipment racks
5. Cable shields.
6. All metal raceways and cable trays for telecommunications cabling extending from the same room or space where the TGB is located.
7. Others as identified on the Drawings.

M. EK BONDING CONDUCTORS SHALL BE TERMINATED WITH ONE-HOLE COMPRESSION LUGS.

END OF SECTION 270526

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings.

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. Coordinate layout and installation of telecommunications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots for fastening cable ties to brackets.

B. Cable Trays: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing.

1. Basket Cable Trays: 6 inches wide and 2 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches.
2. Trough Cable Trays: Nominally 6-inch width.

C. Conduit and Boxes: Comply with Division 26 Section "Common Work Results for Electrical."

1. Minimum Outlet Box Size: 2 inches wide, 3 inches high, 2-1/2 inches deep.

D. Backboards: 3/4 inch, 48 by 96 inches, fire-retardant-treated plywood.

2.2 GROUNDING

A. Comply with requirements in Division 26 Section "Common Work Results for Electrical" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.3 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.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.

B. Install [underground] [buried] [aerial] pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

1. Install [underground] [buried] <Insert pathway> entrance pathway, complying with Division 26 Section "Common Work Results for Electrical."

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 the requirements in 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."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping.

C. 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.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1. GENERAL

1.1 SUMMARY

A. This section includes specifications for twisted pair horizontal station cable, multi-pair copper riser cable, coaxial cable and optical fiber communications cable.

B. OWNER shall provide all Belden/CDT products. Contractor shall provide all other products.

1.2 REFERENCES

A. Category 6 requirements are found in the following the American National Standards Institute (ANSI) and Electronic Industries Association/Telecommunications Industry Association (EIA/TIA) Standards.

1. ANSI/TIA/EIA-568 - A Commercial Building Telecommunications Cabling Standard
2. ANSI/EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

1.3 CODE COMPLIANCE

A. All work and materials shall comply with the most recent rules, codes, and regulations, including but not limited to the following.

1. Occupational Safety and Health Act Standards (OSHA)
2. NFPA 70 - National Electrical Code (NEC)
3. ANSI/IEEE C-2 National Electrical Safety Code
4. All other applicable Federal, State, and local laws and regulations.

1.4 MANUFACTURER'S INSTRUCTIONS

A. When specified in specification sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Shop Drawings and Equipment Brochures.

B. Unless otherwise stated, where installation requirements identified in Reference Standards conflict with the manufacturer's recommendations, the more restrictive shall be apply.

C. Bring to the attention of the Owner and Engineer conflicts between manufacturer's instructions and Contract Documents.

1.5 QUALITY ASSURANCE

A. Full compliance with engineered design and specifications is required.

B. Performance criteria specified in references cited in Paragraph 1.3 shall be met. Test data shall verify system performance.

PART 2. PRODUCTS

2.1 MATERIALS

A. Refer to Division-1 and the General Provisions of the Contract.

B. OWNER shall furnish all Belden/CDT materials. Contractor shall provide all other materials. Contractor shall provide the owner with an estimate of the quantities of the required Belden/CDT materials.

2.2 COMMUNICATIONS CABLES

A. Communications cables shall be type and size (number of pairs) identified for the installation of the various communications systems.

B. Communications cables shall be UL Listed and Approved for intended use. All cable shall be of Type specified by the NEC for use in plenum, non-plenum, and riser spaces.

C. Communications cables installed in cable trays or racks shall be APPROVED for use in such and shall be of fire-resistive construction.

D. Communications cable suitable for use in ducts, plenum, and other space used for environmental air shall be UL Listed as being smoke resistant, shall be Teflon-coated and shall be classified as type CMP communications cable.

E. Communications cable suitable for use in vertical shafts shall be UL Listed for use in such space and shall be classified as type CMR communications cable.

2.3 HORIZONTAL STATION CABLE

A. Shielded Twisted Pair (STP)

1. Acceptable Manufacturers: Belden
2. Plenum Rated: DataTwist 53 ScTP Cable, TIA/EIA-568-B.2, Category 53 Nonbonded-Pair Cables with FEP Teflon insulation and Flamarrest Jacket, colors as designated by Owner.
3. Non Plenum Rated: DataTwist 53 ScTP Cable, TIA/EIA-568-B.2, Category 53 Nonbonded-Pair Cables with Polyolefin insulation and PVC Jacket, colors as designated by Owner.

B. Unshielded Twisted Pair (UTP)

1. Acceptable Manufacturers: Belden
2. Plenum Rated: DataTwist 600e UTP Cable, TIA/EIA-568B.2-1, Category 6, Enhanced Category 6 Bonded Pair Cables with FEP Teflon insulation and Flamarrest jacket, colors as designated by Owner.
3. Non Plenum Rated: DataTwist 600e UTP Cable, TIA/EIA-568B.2-1, Category 6, Enhanced Category 6 Bonded Pair Cables with Polyolefin insulation and PVC jacket, colors as designated by Owner.

C. Optical fiber

1. Plenum Rated: Provide plenum rated multimode grade 6 fiber, exceeding TIA/EIA-568-B.3-1 and ISO 11801 OM3, 50/125 µm aqua PVDF jacket. Provide SC, LC, and ST connectors as indicated on the drawings.

2.4 COPPER RISER CABLE

A. Shielded Twisted Pair (STP)

1. Acceptable Manufacturers: Belden
2. Plenum Rated: DataTwist 53 ScTP Cable, TIA/EIA-568-B.2, Category 53 Nonbonded-Pair Cables with FEP Teflon insulation and Flamarrest Jacket, colors as designated by Owner.
3. Non Plenum Rated: DataTwist 53 ScTP Cable, TIA/EIA-568-B.2, Category 53 Nonbonded-Pair Cables with Polyolefin insulation and PVC Jacket, colors as designated by Owner.

B. Unshielded Twisted Pair (UTP)

1. Acceptable Manufacturers: Belden
2. Plenum Rated: DataTwist 600e UTP Cable, TIA/EIA-568B.2-1, Category 6, Enhanced Category 6 Bonded Pair Cables with FEP Teflon insulation and Flamarrest jacket, colors as designated by Owner.

3. Non Plenum Rated: DataTwist 600e UTP Cable, TIA/EIA-568B.2-1, Category 6, Enhanced Category 6 Bonded Pair Cables with Polyolefin insulation and PVC jacket, colors as designated by Owner.

2.5 CABLE BUNDLING HARDWARE

A. Acceptable manufacturers: Panduit, Velcro Brand, Tyton, U.G. Products Company, Chatsworth Products Incorporated, Great Lakes Case and Cabinet Company, or approved equal.

B. Construction: Re-usable adjustable, cable straps, capable of withstanding fastening to wall with screws, or equipped with snap-and-button fasteners. White color is preferable, else black color. With and without cinch ring as applicable.

2.6 INNERDUCT

A. Acceptable Manufactures: Pyramid and Carlon

B. Plenum Rated: Indoor Corrugated Innerduct, Pyramid P/N PLM100T or equivalent

C. Non Plenum Rated: Indoor Corrugated Innerduct, Carlon P/N 14108R or equivalent

PART 3. EXECUTION

3.1 COPPER CABLE INSTALLATION

A. Requirements of Paragraph 3.1 apply to all cables.

B. Install all cables through primary and secondary pathways. Unless otherwise specified, installation methods and techniques shall satisfy ANSI/EIA/TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

C. Where cables are supported from building structure they shall be adequately supported such that the cable will not be damaged by normal building use.

D. Horizontal station cables shall be home-run from the communication outlet box at the work area to the distribution frame serving the area as shown on the Drawings.

E. Cables shall not be installed or routed in any manner that violates the manufacturer's specifications. Manufacturer's minimum bend radius for static (post installation) cables is 10 times the cable diameter. Manufacturer's minimum bend radius for cables under strain (pulling tension) is 20 times the cable diameter.

F. Unless otherwise specified, terminate cables in accordance with ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Cabling Standard, observing the industry standards for terminating color-coded cables for premises and campus environments.

G. Do not install damaged or defective cable.

H. Installed damaged cable will not be accepted. Unless otherwise allowed by the Owner, damaged cable shall be removed and new cable installed at the expense of the Contractor. Damage includes physical damage to the cable and damage that may affect performance. THE OWNER WILL NOT ACCEPT CABLE OF ANY TYPE UNTIL AFTER IT IS INSTALLED AND PASSES A PHYSICAL INSPECTION AND ALL PERFORMANCE TESTS.

I. The Contractor shall field survey and review with the Owner and Engineer similar installations on site that contain the same type of materials that are used for this Project to gain the desired routing and layout, installation techniques, and finished-look prior to start of construction and as often as necessary during the construction process.

3.2 CABLE SUPPORT ALONG PRIMARY PATHWAY

A. Primary pathways include major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas which are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.

B. Where cable tray cannot be installed to be continuous, provide support and strain relief for cables using mechanical fasteners such as J-hooks, conduit, C-channel, and other necessary devices to support cables around discontinuity. In exposed areas support cables as indicated on Drawings.

C. Where a telecommunication raceway, cable tray, or cable rack is provided, all telecommunication cables shall utilize the system except:

1. Emergency system wiring
2. Fire alarm systems

D. Cables shall be routed to avoid cable crossover between cable continuing vertically floor-to-floor and cable routed horizontally.

E. Cable installation and cable routes shall be planned and cables shall be installed such that the capacity of the conduit, sleeves, and cable tray is used most efficiently.

F. Bundle and route cables throughout the building to maintain neat, uniform, and combed bundles. Where cable is exposed in vertical runs, such as utility shafts, provide reusable cable straps to neatly contain cable bundles.

G. Provide strain relief for cables routed vertically using mechanical fasteners such as conduit, C-channel, reusable cable straps, other necessary devices to support cables.

3.3 CABLE SUPPORT ALONG SECONDARY PATHWAY

A. Secondary pathways extend from the primary pathway to the communication outlet box. Secondary pathways carry cable from the primary pathway to the communication outlet box.

B. Cable shall be routed parallel and perpendicular to walls and floor from the primary pathway to the outlet box. WHERE MULTIPLE ROUTES ARE POSSIBLE, ROUTE CABLE ALONG THE SHORTEST ROUTE TO MINIMIZE CABLE LENGTH AS PRACTICABLE.

C. Do not use suspended ceiling support hangers (wires) to support station cables.

D. Do not support cable from other mechanical, electrical, or plumbing, systems.

E. Station cables shall be supported such that they do not rest on the suspended ceiling system.

F. Cables and cable pathways shall be supported from the building structure. Superstructure designed and intended to support multiple utilities may be used as a superstructure for communications cables if the superstructure can physically support the additional load and if the support mechanism for the cable works for supporting the cable from the superstructure.

3.4 CABLE BUNDLING HARDWARE

A. Cable bundling hardware shall be rated for the environment and application in which used. Applications include, but are not limited to, general purpose, outdoor, chemical resistant, flame retardant, high temperature, and vibration.

B. Provide reusable cable management straps for bundling and securing horizontal station cables and equipment jumper cables within entrance facilities and telecommunication closets. Do not use nylon cable ties.

C. Provide reusable cable management straps for bundling and securing horizontal station cables at primary vertical pathways. Do not use nylon cable ties.

D. Do NOT strap horizontal station cable to cable tray and ladder rack.

3.5 CROSS-CONNECT JUMPERS

A. Owner will install all cross-connect jumpers.

B. Provide 2” minimum and 4” maximum service loop in each cross-connect jumper for voice and data circuits at each end.

C. Cross-connect jumpers shall be uniform in shape.

D. Plan and route cross-connect jumpers for voice circuits and data circuits through the jumper rings on the frames such that they are not intermixed haphazardly. Keep voice and data cross-connect jumpers segregated as possible.

3.6 CABLE MANAGEMENT AND ROUTING AT DISTRIBUTION FRAMES

A. At distribution frames route cables along the backboard vertically and horizontally to avoid diagonal routing. Where the termination location is unspecified, neatly coil enough cable slack in each closet to reach the farthest corner of the backboard routing vertically and horizontally.

B. Plan cable layout, routing, and cable management on the backboard such that:

1. Cable cross-over is minimal.
2. Cables are kept as short as practicable.
3. Station cables and equipment cables are neatly shaped, combed, and bundled vertically and horizontally.

3.7 COPPER CABLE SPLICES

A. Horizontal station cables shall not be spliced.

B. Splices in backbone cables shall be made using mechanical tools, modules, and connectors of the same manufacturer which are specifically designed for the type and size of cable being spliced.

C. All splices shall be performed in a splice closure specifically designed for the number of cables, size of cables, quantity of conductors, and environment of the splice.

D. Metallic shields of telecommunications cables shall be bonded together within the closure of all splices.

E. All cables entering a splice case shall be supported independent of the splice case to a supporting structure and such that the splice case is accessible for re-entry.

F. Splicing of cables containing energized circuits shall be coordinated with Owner.

3.8 CABLE REMOVAL

A. All copper riser cable, horizontal station cable, and termination hardware that is replaced with new shall be removed.

B. Existing twisted pair communications cable and hardware in the project area that has been abandoned in place prior to this Project shall be removed.

C. Conduit and enclosures shall remain. Blank covers shall be provided for abandoned outlet boxes.

D. All penetrations and sleeves affected by removal of cable shall be fire-stopped after removal of cable to maintain required fire rating.

E. Existing termination hardware within the existing telecommunications spaces and communications enclosures shall be removed from service after cutover.

F. Existing distribution frame hardware and cabling shall be removed after active services are transferred to new cabling system as verified at frame.

3.9 OPTICAL CABLE INSTALLATION AND ROUTING

A. The optical fiber cable shall be installed after complete installation of the innerduct if innerduct is specified.

B. All optical fiber cable shall be home-run. Cables shall not be spliced.

C. The cable shall be installed in accordance with the manufacturer's specifications for installation and loading. The short and long term cable loading values shall not be violated.

D. The manufacturer's minimum bending radius under both loaded and unloaded conditions shall not be violated. Cable wrinkling shall be avoided.

E. Cable and innerduct routes shall be defined prior to installation such that the cable lengths are accurate, such that securing cable in place will not result in shortage of cable, and such that desired routing paths are not compromised because of inaccurate planning and coordination.

F. A service loop of 10 feet (minimum) shall be provided at both ends of the cable unless otherwise indicated on the drawings. The location of the service loop shall be placed such that the cable can be extended without interference of other systems such as mechanical systems, electrical piping, plumbing, racking, etc. The direction of the loop (i.e., clockwise or counter-clockwise) shall be such that the cable enters the rack and distribution hardware with minimal bends. The service loop shall be stored out-of-way and fastened to prevent possible damage.

3.10 GENERAL OPTICAL FIBER TERMINATION

A. All Single-mode fiber shall be fusion spliced, fiber to fiber or fiber to factory made jumper with ST connectors. All Single-mode fiber will have ST connectors.

B. Backbone (multimode) optical fiber cables shall be directly terminated with SC composite/ceramic connector in accordance with the connector manufacturer's recommendations. All Single-mode fiber will be fusion spliced to jumpers

C. Cable and fiber protection, installation, and termination shall be according to the connector manufacturer's recommended practices and shall use the manufacturer's kits, processes, cleaners, solvents, fasteners, and other mechanisms necessary for a complete termination unless otherwise indicated herein.

D. Unless otherwise indicated, all cable routing, management, preparation, protection, installation, and storage shall be according to the hardware manufacturer's recommended practices and shall use the manufacturer's kits, processes, cable and fiber management hardware, fasteners, and other mechanisms necessary for a complete installation.

E. The multimode fibers shall be terminated with a connector that is beige in color and shall be inserted into the adapter that is beige in color. The single-mode fibers shall be terminated with a connector that is blue in color and inserted into the adapter that is blue in color.

F. Cable and fiber terminations shall be labeled. Contractor shall provide information per Owner furnished cable recording documents.

G. Cable termination shall incorporate industry standard color coding and positioning within the enclosures. Refer to Paragraph 3.8.4 for adapter orientations.

H. The connector panels that contain the SC adapters shall accommodate six adapters (six fibers). See paragraph 3.8.4 for orientation of the adapters for desired polarity.

3.11 FIBER TERMINATION WITHIN RACK MOUNT PATCH PANELS

A. Coordinate with Owner and Engineer to field review the installation of enclosures and hardware to gain desired installation techniques and placement practices before their installation throughout campus buildings.

B. Install the Patch Panels as shown on the drawings. Unless otherwise shown, all enclosures shall be installed tight to each other in the equipment racks.

C. The Patch Panels shall be installed with connector panels in low density configuration.

D. Install Single-mode and Multimode fibers in separate Patch

3.12 FIBER TERMINATION ADAPTER ORIENTATION

A. Specific orientation of the adapters is necessary to maintain the correct polarity to transmit and receive signals throughout the site. Polarity is achieved by physical key slot orientation of adapters in the fiber distribution enclosures. The adapter orientation that shall be applied will be included with the fiber cable recording documents from the Owner and Engineer.

B. Physical orientation of the adapters shall be achieved by removing and rotating the adapter within the connector panel to the proper key-slot-up or key-slot-down.

3.13 WIRE AND CABLE IDENTIFICATION

A. Provide labels as specified in Section 270553.

END OF SECTION 271500

SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Comply with NFPA 70.

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-steel sheet.

D. Sleeve Seals: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL ELECTRONIC SAFETY AND SECURITY EQUIPMENT INSTALLATION REQUIREMENTS

A. Install electronic safety and security equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

B. Install electronic safety and security equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.

C. Install electronic safety and security equipment to allow right of way for piping and conduit installed at required slope.

D. Install electronic safety and security equipment to ensure that connecting pathways and cables are clear of obstructions and of the working and access space of other equipment.

E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."

G. Install sleeve and sleeve seals of type and number required for sealing electronic safety and security service penetrations of exterior walls.

3.2 SLEEVE AND SLEEVE-SEALS INSTALLATION

A. 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.

B. Cut sleeves to length for mounting flush with both wall surfaces.

C. Extend sleeves installed in floors 2 inches above finished floor level.

D. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed [or unless seismic criteria require different clearance].

E. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies].

F. 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."

G. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

H. 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.

I. 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.

3.3 FIRESTOPPING

A. Apply firestopping to electronic safety and security penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 280500

SECTION 283111 - NEW ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire alarm system as shown on plans and herein specified.
2. Cable and conduit for a complete operating system.
3. System smoke detectors.
4. Notification appliances.
5. Addressable interface device.
6. Digital alarm communicator transmitter.
7. Connections to existing analog zones.
8. Fire alarm acceptance testing.

B. The system shall be new and shall have network capabilities for connection of both data center and office building. Use NAC extender panels on every floor of office building. The master control panel shall be within the security office and the secondary control panel for data center (and pre-action panel system) shall be located at mantrap security station.

C. Fire Alarm System to be provided by Automated Control Systems. Contractor shall contact Dave Lockwood with ACS, 816-533-4338, for quote.

1.2 SYSTEM DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

D. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

E. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

F. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity

G. Non-coded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
    a. Trained and certified by manufacturer in fire-alarm system design.

B. Product Data: For each type of product indicated.

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 performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
4. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems 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. 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.
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. Copy of NFPA 25.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Notifier NFS-320 / NFS2-640 addressable control panel (depending on # of nodes)
2. Simplex 4010 addressable control panel
3. Siemens FC-922 addressable control panel

2.2 CONDUIT AND WIRE

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-55.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
6. All field wiring shall be electrically supervised for open circuit and ground fault.
7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE

A. Main FACP or network node shall be a Siemens FC-922 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control

1. Acknowledge Switch:
   a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:

   a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch:

   a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch:

   a. Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test:

   a. The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal

A. System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
3. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits
4. The Notification Appliance Circuits shall be programmable to synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
5. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.

6. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
7. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.
8. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
9. The FACP or each network node shall provide the following features:

    a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
    b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
    c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
    d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
    e. The ability to display or print system reports.
    f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
    g. PAS pre-signal, meeting NFPA 72 3-8.3 requirements.
    h. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 Chapter 1 requirements for activation of notification circuits within 10 seconds of initiating device activation.
    i. Periodic detector test, conducted automatically by the software.
    j. Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
    k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
    l. Walk test, with a check for two detectors set to same address.
    m. Control-by-time for non-fire operations, with holiday schedules.
    n. Day/night automatic adjustment of detector sensitivity.
    o. Device blink control for sleeping areas.

10. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."
11. Network Communication

    a. The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

C. Central Microprocessor

1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

D. System Display

1. The system shall support the following display mode options:

   a. The CPU with no display option shall allow the fire alarm control panel to function as a data-gathering panel when the panel is connected to a network with a Network Control Station (NCS) or Network Control Annunciator (NCA). In this application, the NCS or NCA shall provide all of the necessary controls and indicators to be used by the system operator. Programming of the CPU may be accomplished from the NCS or by use of a laptop PC with the software programming utility connected directly to the CPU.
   b. 80 character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
   c. 640-character display option. The design of the CPU shall provide for a configuration with the 640 Character display mounted on the front of the CPU in place of the standard 80-character display.

2. The display shall provide all the controls and indicators used by the system operator:

   a. The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
   b. The 640-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.

3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The display shall also provide Light-Emitting Diodes.

   a. The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.

5. The 640-character display shall provide 11 Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY EVENT, SYSTEM TROUBLE, ALARM SILENCED, DISABLED POINTS, OTHER EVENTS, CPU FAILURE and Controls Active.
6. The display shall have QWERTY type keypad.
    a. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
    b. The 640-character display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility.
7. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

E. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

F. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
    a. One EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.
    b. One EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.
    c. One EIA-232 interface shall be used to connect a UL-listed CRT terminal. This interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.
    d. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
    e. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

G. Voice Command Center (VCC)

1. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. A Message generator shall be capable of automatically distributing up to four (4) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

    a. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of at least 16 or 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.
    b. The audio portion of the system shall sound the proper audio signal (consisting of tone, voice, or tone and voice) to the appropriate zones.
    c. Notification Appliance Circuits (NAC) speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.
    d. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
    e. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
    f. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.

2. The emergency voice alarm communication system shall incorporate a Two-way emergency telephone communication system.

    a. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
    b. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
    c. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.

H. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

I. Power Supply:

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
   Ground Fault LED
   AC Power Fail LED
   NAC on LED (4)
5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
7. All circuits shall be power-limited, per UL864 requirements.

J. Auxiliary Field Power Supply - Addressable

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is se-

lected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.

13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Field Charging Power Supply (FCPS)

The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount backbox.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.

L. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:

    a. Device status
    b. Device type
    c. Custom device label
    d. View analog detector values
    e. Device zone assignments
    f. All program parameters

5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time

and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c. All devices tested in walk test shall be recorded in the history buffer.
11. Waterflow Operation
    a. An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
12. Supervisory Operation
    a. An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
13. Signal Silence Operation
    a. The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.
14. Non-Alarm Input Operation
    a. Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
15. Combo Zone
    a. A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4 SYSTEM COMPONENTS

A. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as shown on plans.

B. Speakers:

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

C. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

D. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be non-code, non-break glass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be re-stored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet front or side.
4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

E. Conventional Photoelectric Area Smoke Detectors

1. Photoelectric smoke detectors shall be a 24 VDC, two wire, ceiling-mounted, light scattering type using an LED light source.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash at least every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet per minute.
7. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
8. All field wire connections shall be made to the base through the use of a clamping plate and screw.

F. Conventional Ionization Type Area Smoke Detectors

1. Ionization type smoke detectors shall be a two wire, 24 VDC type using a dual unipolar chamber.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs) over 360 degrees, on the detector, which may be seen from ground level. This LED shall flash every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not alarm when exposed to air velocities of up to 1,200 feet per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.

7. All field wire connections shall be made to the base through the use of a clamping plate and screw.

G. Duct Smoke Detectors

a. Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

H. Projected Beam Detectors

1. The projected beam type shall be a 4-wire 24 VDC device.
2. The detector shall be listed to UL 268 and shall consist of a separate transmitter and receiver capable of being powered separately or together.
3. The detector shall operate in either a short range (30' - 100') or long range (100' - 330') mode.
4. The temperature range of the device shall be -22°F to 131° F.
5. The detector shall feature a bank of four alignment LEDs on both the receiver and the transmitter that are used to ensure proper alignment of unit without special tools.
6. Beam detectors shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses.
7. The unit shall be both ceiling and wall mountable.
8. The detector shall have the ability to be tested using calibrated test filters or magnet activated remote test station.

I. Automatic Conventional Heat Detectors

1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135° F for areas where ambient temperatures do not exceed 100 °F, and 200°F for areas where the temperature does not exceed 150°F.
2. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15°F per minute.
4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic heat detectors shall have a smooth ceiling rating of 2500 square feet.

J. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one foot from a fitting which changes the direction of the flow and a minimum of three feet from a valve.

K. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

    a. This unit shall provide for each zone: alarm indications, using a red alarm a yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
    b. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.

L. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
7. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a keyswitch or password.
8. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.
9. Equal by the following:

    a. Siemens LCD series
    b. Notifier LCD-80
    c. Simplex 4606-9101

M. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on the plans. Jacks shall be approved for emergency telephone system application.
2. Insertion of a portable handset plug into a jack shall send a signal to the fire command center, which shall audibly and visually indicate the on-line condition, and shall sound a "ring" indication in the handset.
3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

N. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled as "Emergency Telephone." The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection so that lifting the handset off of the cradle shall send a signal to the fire command center, which shall audibly and visually indicate its on-line (off-hook) condition.

3. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.
4. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

O. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

P. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
5. Communication shall include vital system status such as:

    a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
    b. Independent Addressable Device Status
    c. AC (Mains) Power Loss
    d. Low Battery and Earth Fault
    e. System Off Normal
    f. 12 and 24 Hour Test Signal
    g. Abnormal Test Signal (per UL requirements)
    h. EIA-485 Communications Failure
    i. Phone Line Failure

6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

Q. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

R. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

S. Video Display Terminal

1. The Video Display Terminal shall provide a visual display and an audible alert of all changes in status of the system and shall annotate such displays with the current time-of-day and date.
2. The Video Display Terminal shall be enclosed in a cabinet suitable for placement on a desktop or table.
3. A detachable keyboard shall be provided that may be used for programming, testing, and control of the system. Individual keys shall be provided on the keyboard for the ACKNOWLEDGE, RESET, LAMP TEST, SYSTEM TEST, and SIGNAL SILENCE functions of the control panel.
4. The video display terminal shall include a count of all alarms and troubles in the system, as well as a count of all alarms and trouble requiring acknowledgment. These counts shall be continuously displayed during all FACP operations.

2.5 SYSTEM COMPONENTS – ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Bases shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.
8. 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 initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in

the FACP program and allowing the system operator to view the current analog value of each detector.

11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square, 2-1/8 inch deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (Manual Station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

C. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) 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.

D. Intelligent Laser Photo Smoke Detector

1. The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
2. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
3. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.03 percent per foot.
4. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
5. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
6. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
7. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector

1. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15°F per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

I. Hostile-Area Smoke Detector

1. The detector shall be designed to provide early warning smoke detection in environments where traditional smoke detectors are not practical.
2. The detector shall have a filter system to remove particles down to 25 microns.
3. This filter system shall remove unwanted airborne particles and water mist. This shall allow the detector to operate in environments where traditional smoke detectors would have nuisance alarms.
4. The filter system shall consist of 2 filters one of which is field replaceable.
5. The filter system shall have an intake fan to draw air and smoke through the filters into the sensing chamber.
6. The filter system shall be supervised so that if the filter is clogged or the fan fails the control panel reports trouble.
7. The filter system shall be powered from 24 VDC separate from the SLC communications.
8. The detector shall utilize a photoelectric sensing chamber.

J. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

K. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

L. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

M. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

N. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

O. Smoke Control Annunciator

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.6 BATTERIES:

A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery and charger systems may be used.

2.7 CABLE

A. Alarm initiating circuit shall wiring and annunciator wiring shall be of type and size recommended by equipment manufacturer. Cable shall be U.L. Listed for use with local protective signaling system.

2.8 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Activate emergency lighting control.
8. Activate emergency shutoffs for gas and fuel supplies.
9. Record events in the system memory.

C. 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.
10. Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system.

D. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

E. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. 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.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

F. 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.).

2.9 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. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

E. Visible 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.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished; red.

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.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. 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.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in 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.

C. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section 260533, "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.3 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.

3.4 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. 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.
3. Test visible appliances for the public operating mode according to manufacturer's written instructions.
4. 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.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.5 INSTALLATION

A. All wiring shall comply with NEC Section 760-3 and NFPA Pamphlet 72A, Class B.

B. Comply with equipment manufacturer's written instructions.

C. All wiring shall be continuous from terminal to terminal or from terminal to device pigtail lead. Wiring shall be color coded and color coding scheme shall be used consistently throughout.

D. All fire alarm system wiring shall be installed in a separate conduit system for fire alarm conductors only. All fire alarm system device boxes, junction boxes, pull boxes, etc. shall be painted red.

E. Device boxes in new construction areas shall be flush mounted; device boxes in renovated areas shall be surface mounted.

F. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

3.6 TEST

A. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

D. Verify activation of all waterflow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open and short signaling line circuits and verify that the trouble signal actuates.

G. Open and short notification appliance circuits and verify that trouble signal actuates.

H. Ground all circuits and verify response of trouble signals.

I. Check presence and audibility of tone at all alarm notification devices.

J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.7 INSTRUCT OWNER'S PERSONNEL

A. Provide one 2 hour seminar for instruction of 4 personnel in the operation of the system. Seminar shall be conducted by manufacturer's representative.

3.8 CERTIFICATION

A. System shall be thoroughly tested by the manufacturer's representative. Testing shall be performed in the presence of the local Fire Department Representative. Contractor shall notify Engineer prior to testing. Contractor shall issue a written certification statement that all equipment has been installed in accordance with plans and specifications and also manufacturer's wiring diagrams, instructions, and directions. Certification shall state that the system is in complete proper operating order.

END OF SECTION 283111

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil treatment with termiticide.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product certificates.

C. Soil Treatment Application Report: Include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

D. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single source from single manufacturer.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil to tops of footings and grade beams; and beneath ground-supported slabs before construction.

1.6 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five (5) years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

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, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered non-repellent type 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.
   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. BASF Corporation, Agricultural Products; Termidor.
      b. Bayer Environmental Science; Premise 75.
      c. FMC Corporation, Agricultural Products Group; Dragnet FT.
      d. MasterLine/Univar; I-Maxx.
      e. Syngenta; Prelude.
   2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.2 APPLYING SOIL TREATMENT

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and to bottoms of footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

D. 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.
   1. Slabs-on-Grade and Basement Slabs: Beneath ground-supported slab construction, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete is placed.
      a. Treat soil materials beneath floor slabs on grade extending to perimeter of building on all sides.
   2. Foundations and Grade Beams: Adjacent soil, including soil along the entire inside perimeter of foundation walls and grade beams; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to top of footing and bottom of grade beam as occurs, but in no case less than 4 feet in depth, unless required otherwise on termiticide manufacturer's EPA-Registered Label. Avoid soil washout around footings.
   3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

E. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

F. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

G. Post warning signs in areas of application.

H. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 313200 - SOIL STABILIZATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Excavating and backfilling for buildings within building lines.
   2. Preparing subgrade for building slabs on grade.

B. Related work in other sections:
   1. Section 033000 “Cast-in-Place Concrete” for granular drainage fill beneath building pad.
   2. Excavating and Backfilling for Plumbing, Mechanical and Electrical Work: Divisions 22, 23 and 26.
   3. Civil Specifications indicated on Drawings.

1.2 DEFINITIONS

A. Excavation consists of removal of material encountered to design subgrade elevations indicated, and below design subgrades, where yielding soils are encountered and subsequent disposal of materials removed.

B. Subgrade: The undisturbed earth (subsoil) or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

C. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

D. Proofrolling: The utilization of earth moving equipment to identify unstable and unsuitable insitu subsoils and subgrade materials. Soil at or below subgrade level which are soft, unstable and generally unsuitable for intended use; as determined by Owner’s Soils Engineer. Unsuitable areas shall be improved by compaction or by under cutting and placement of suitable compacted fill. Proofrolling shall be accomplished with a fully loaded, tandem-axle dump truck loaded to 20,000 pounds per axle or other equipment providing an equivalent subgrade loading.

E. Drainage/Capillary Break Granular Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

F. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

G. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

H. Design Subgrade Elevation: For the purpose of this Section, design subgrade elevations are defined as follows:
   1. For footings, foundation walls, grade beam foundations and retaining walls; design subgrade shall be the bottom of the footing, foundation wall and grade beam foundations as shown on the drawings cut into soil material.
   2. For slabs on grade; design subgrade elevation shall be the bottom of the low volume change (transition layer) material as set forth in the specifications.
   3. No additional cost shall be included when rock and below grade improvements are encountered within 22" below design subgrade elevation as defined for items 1 and 2 above.
   4. No additional cost shall be included when yielding unsuitable subgrades are encountered beneath design subgrade elevation as defined for items 1 and 2 above.

1.3 ACTION SUBMITTALS

A. Materials Certificates: Provide materials certificates signed by manufacturer and Contractor, certifying that imported low plasticity soil, well graded granular materials and flyash comply with, or exceeds, specified requirements.

B. Test Reports: Submit the following reports directly to Architect and Owner's Soils Engineer from the testing services, with copy to Contractor. Test reports shall be submitted not more than seven (7) calendar days prior to incorporation into the work.
   1. Contractor's Testing Responsibilities:
      a. Test reports on off-site borrow material proposed.
   2. Owner's Testing Responsibilities:
      a. Verification of suitability of each footing, building slab and pavement, subgrade material, in accordance with specified requirements.
      b. Field reports; in-place soil density tests.
      c. One optimum moisture-maximum density curve for each type of soil encountered.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform work of this Section in compliance with applicable requirements of the City of Independence, Missouri, and the following:
   1. International Building Code as adopted by the City.

B. Soils Testing:
   1. The Owner will employ a licensed geotechnical engineer registered in the state where the project is located to: test and approve all fill material within the building pad area; inspect and approve exposed building pad subgrade materials before placement of low volume change (transition layer) fill material and granular drainage fill; inspect and approve soil at footing bearing elevations; test and approve compacted fill during and after placement; and verify that the soil under floor slabs is at the specified moisture content immediately prior to placing concrete floor slabs.
   2. The Contractor shall employ a Testing Laboratory acceptable to the Architect to test all borrow material.

C. Testing Laboratory Qualifications: To qualify for acceptance, the GeoTechnical Testing Laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM B 699, that it has the experience and capability to conduct required field and laboratory GeoTechnical testing without delaying the progress of the Work.

1.5 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are included in these specifications and are for the Contractor's information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
   1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
   2. All earthwork and soil stabilization shall be performed in accordance with the specifications and the recommendations in the aforementioned GeoTechnical Report and in compliance with applicable requirements of governing authorities having jurisdiction. Where conflicts occur between requirements the more stringent requirement will govern.
   3. Building Pad Subgrades: It may be necessary for the Earthwork Contractor to recondition the subgrade and bring subgrade to final design elevation.

B. Existing Utilities: Contractor shall verify and confirm locations of existing underground utilities within the area of the building pad. Where utilities are indicated to remain in place, provide adequate means of support and protection during soil stabilization operations.
   1. Should uncharted, or incorrectly charted utilities be encountered during soil stabilization operations, consult Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Owner.

2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
   a. Provide minimum of 72-hour notice to Architect, and receive written Notice to Proceed before interrupting any utility.

1.6 PROTECTION

A. Traffic: Conduct work of this Section to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Clean roads and streets of debris caused by work under this Section daily.

B. Warning Lights: Provide and operate warning lights as recommended by authorities having jurisdiction.

C. Protecting Existing Improvements: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by soil stabilization operations.
   1. Protect improvements on adjoining properties and on Owner's property.
   2. Restore damaged improvements to their original condition, as acceptable to Property Owners.

D. Protecting Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General site clearing and earth moving are specified in Sections 311000 and 312000, respectively. Owner's Soils Engineer will approve all structural fill for the low volume change material used for the low volume change (transition layer) beneath building slabs. It is the Contractor's option to use approved off-site borrow material, approved granular fill material or approved on-site soils (if any exists) for the low volume change (transition layer) material.
   1. Deep Fill Areas: Areas requiring fill that are below the low volume change (transition layer) material may utilize the following fill materials:
      a. Crushed rock, as approved by Owner's soils engineer.
      b. On-site soil material, as approved by Owner's soils engineer.

B. Structural Fill For Low Volume Change (Transition Layer): Contractor may utilize one of the following materials listed below. All structural fill materials must be approved by the Owner's Soils Engineer. Structural fill material shall be free of organic matter (organic content less than 5 percent) and debris.
   1. Approved off-site borrow material of inorganic low plasticity cohesive soil (Liquid Limit less than 45, and Plasticity Index less than 22, when determined in accordance with wet preparation procedures outlined in ASTM D 4318).
   2. Approved well-graded granular materials.

C. Granular Drainage Fill: Refer to Section 033000.

D. Backfill of Building Pad Areas: Use same material specified for the Structural fill for the Transition layer.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor shall verify the location and depth of all utilities within the building pad at least 72 hours prior to construction. Prior to commencement of work, the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulation materials as necessary.

C. The Contractor shall maintain the building pad site, areas to receive paving, and conduct soil stabilization operations to ensure that the property is well drained at all times.

D. The Contractor shall survey or shall engage a registered professional surveyor to survey and layout all stakes, batterboards, etc. in a timely manner prior to and during construction operations.
   1. Owner's surveyor/professional engineer will layout two primary building control lines and levels, establish building corners for Contractor to work from at site.

3.2 PROTECTION

A. Protect utilities that remain from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or negligent actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

B. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

C. Protect benchmarks from excavation equipment and vehicular traffic.

D. The Contractor shall protect all property corners and control monuments from damage or displacement. Should it become necessary to disturb any corner or monument, the Contractor shall be responsible for referencing the markers prior to removal, resetting them and filing such relocation in accordance with state and local regulations. All such work involving property corners and control monument shall be performed by Contractor's registered, licensed land surveyor. A copy of all certification documents shall be submitted to the Engineer prior to completion of the project.

E. Prevent surface water and subsurface or ground water from entering building pad excavations, from ponding on prepared subgrades, and from flooding building pad and pavement areas.

3.3 SITE CLEARING

A. General: Removal of trees, shrubs, grass and other vegetation, improvements, and obstructions is specified under Section 311000.

B. Topsoil: Topsoil removal is part of the work specified under Section 311000. Topsoil shall be removed and stored on-site at location as directed by the Owner.

C. General earth moving operations and requirements is specified in Section 312000.

3.4 EXCAVATION

A. General: It should be anticipated that areas of existing fill and shallow bedrock will be encountered.
   1. Once planned subgrade elevation is achieved in cut areas and the surface materials are stripped in fill areas, remaining existing fill will be evaluated by Owner's soils engineer by means of test pits and proofrolling.
      a. Contractor shall plan on providing at least 2 test pits per project site as directed and located by Owner's soils engineer. Additional test pits shall be provided on a "Unit Price" basis per pit.
   2. Any soft and unsuitable fill encountered and verified shall be undercut to suitable material as directed by Owner's soils engineer.

B. Excavation is unclassified and includes excavation to design subgrade elevations indicated, in addition to yielding unsuitable soil below design subgrade elevations, regardless of character of materials and obstructions encountered.
   1. General excavation and site grading is specified under Section 312000: The area of the building pad extending 5'-0" beyond the building lines will be prepared under Section 312000 and should be brought to within 0.10' of the bottom of the transition layer design subgrade elevation.

C. Prior to placement of low volume change (transition layer) materials and in presence of Owner's Soil Engineer, evaluate subgrade moisture content, density and proofroll exposed subsoil to identify and delineate unsuitable yielding subgrade areas.

1. Unsuitable and unstable areas shall be improved by undercutting and placement of suitable compacted fill as specified in this Section.

3.5 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace areas adjacent to existing foundations and where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.
   1. Owner's Soils Engineer will determine extent of permanent shoring required. Contractor shall place shoring and bracing adjacent to existing building where excavation is necessary to accommodate new construction.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect.

3.6 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into building pad excavations.
   1. Do not allow water to accumulate in excavations and on prepared subgrades. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of building pad subgrades, and building foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
   2. If prolonged ponding of surface water occurs, removal and replacement of wet or disturbed soils may be necessary as determined by Owner's Soils Engineer.

3.7 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where shown on drawings or as directed by Architect. Place grade, and shape stockpiles for proper drainage.
   1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
   2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.8 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10' and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.
   1. Extend excavation for building pad 5'-0" beyond building lines.
   2. Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
   3. Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10'; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

3.9 EXCAVATION FOR TRENCHES

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6" to 9" of clearance on both sides of pipe or conduit. Excavate trenches beneath building pad to drain away from the building.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   1. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of 1" minus graded material or low plasticity clay prior to installation of pipe.
   2. For pipes or conduit less than 6" in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond required depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
   3. For pipes and equipment 6" or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90○ (bottom 1/4th of the circumference). Fill depressions with low plasticity clay. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.10 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.11 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
   1. Under building slabs: Use drainage/capillary break granular fill material from bottom of slab-on-grade down 6", use structural fill transition layer material from bottom of drainage fill down 24". Shape excavation bottom to fit bottom 90 degree of cylinder.
      a. Construct clay “trench plugs” extending at least 5 feet out from face of building exterior at each trench location extend beyond building lines.

B. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Visual inspection by Owner's Soils Engineer of foundation bearing materials.
   2. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
   3. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
   4. Removal of concrete formwork.
   5. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
   6. Removal of trash and debris from excavation.
   7. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.12 FILL PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip or break up sloped surfaces steeper than 1 vertical to 5 horizontal so that fill material will bond with existing surface.
   1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

B. Place backfill and fill materials in layers not more than 8" in loose thickness for material compacted by heavy compaction equipment, and not more than 4" to 6" in loose thickness for material compacted by hand-operated tampers (hand-guided equipment).
C. Before compaction, moisten or aerate each layer as necessary to adjust soil water content to specified range as determined by Owner's Soils Engineer. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Owner’s Soils Engineer if soil density tests indicate inadequate compaction.

E. Percentage of Maximum Density Requirements: Compact fill materials to not less than the following:

1. Inorganic low plasticity cohesive soil and, on-site or imported soil materials: Compact each layer of backfill or fill material to at least 95 percent of material's maximum dry density per ASTM D 698.
2. Granular (cohesionless) fill materials: Where percentage passing the U.S. Standard No. 200 sieve is less than 15 percent by dry weight and the moisture density curve indicates only slight sensitivity to changing moisture content, compact each layer of backfill and fill material to at least 70 percent Relative Density in accordance with ASTM D 4253.

F. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations. Mix by disking or other methods to achieve uniform water content throughout fill material. Moisture content will be determined by Owner's Soils Engineer.
1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
2. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.
3. Moisture content of moderate to high plasticity clay fill (Liquid Limit >40) shall be as follows:
   a. Within the range of optimum moisture content from 0 to 4 percent above optimum moisture content as determined by standard Proctor dry density (ASTM C 698).
4. Moisture content of low to moderate plastcity clay fill (Liquid Limit $\leq$ 40) shall be as follows:
   a. Within the range of optimum moisture content from -2 to +2 percent of optimum moisture content as determined by standard Proctor dry density (ASTM C 698).
5. Moisture content of granular material shall be as follows:
   a. Workable moisture levels.
6. Aeration or wetting may be required to achieve compaction.

G. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

3.13 GRADING

A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½" when tested with a 10' straightedge.

C. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.14 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
1. Perform field density tests using the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gauges in accordance with ASTM D 3017.
   a. Make calibration checks of both density and moisture gauges at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.
2. Footing Subgrade: For each strata of soil on which footings (or grade beams) will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Owner's Soils Engineer.
3. Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq ft of paved area or building slab, but in no case fewer than three tests.
   a. In each compacted fill layer, perform one field density test for every 2,000 sq ft of overlaying building slab or paved area, but in no case fewer than three tests.

4. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.
5. If in opinion of Owner's Soils Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.15 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded building pad areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact and replace surface treatment. Restore appearance quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal off Site: Transport and legally dispose of waste materials and unsuitable topsoil materials to an off site location acceptable to Construction Manager.

END OF SECTION 313200

SECTION 321723 – INTERIOR PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.
   1. Coordinate locations with Owner for markings on interior concrete slabs.

B. Related Requirements:
   1. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement.
   2. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to marking pavement including, but not limited to, the following:
      a. Pavement aging period before application of pavement markings.
      b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.
   1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
   2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of MoDOT for pavement-marking work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

A. General: Paint shall be formulated and manufactured from first-grade materials and shall be fast drying, water-based, acrylic resin type paint capable of withstanding air and roadway temperatures without bleeding, staining, discoloring and deforming. Dried paint film shall be capable of maintaining its original dimensions and placement without chipping, spalling and cracking. In addition, paint shall not deteriorate because of contact with sodium chloride, calcium chloride, mild alkalies and acids, and other ice control materials; as well as oil, gasoline and diesel drippings from vehicles.

B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 10 minutes. Dry through time shall not exceed 150 minutes.
   1. Colors: Provide white, yellow, red and blue as indicated and as required for typical industry recognized applications.

C. Glass Beads: AASHTO M 247, Type 1.
   1. Roundness: Minimum 75 percent true spheres by weight.
   2. Reflectance by Color according to ASTM E 1347.
      a. White: Not less than 87 percent.
      b. Yellow: Not less than 50 percent.
      c. Red and Blue: Not less than 40 percent.

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 60 days before starting pavement marking, unless specifically allowed by paint manufacturer in installation/application instructions.

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 the stencil. Apply paint so that it cannot run beneath the 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 321723

SECTION 334600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of drainage work:
   1. Drainage system at perimeter of foundations.

1.2 ACTION SUBMITTALS

A. Manufacturer's technical product data and installation instructions. Include data substantiating that materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Certification: Submit Certification signed by Contractor and drainage system Installer that installed materials conform to specified requirements and system was successfully checked and tested prior to covering with backfill material.

1.4 CLOSEOUT SUBMITTALS

A. Submit Project Record Documents under provisions of Section 01700 and as follows:
   1. Accurately record actual locations of pipe runs, connections, and invert elevations of the system.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed drainage systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 COORDINATION

A. Coordinate drainage system installation with excavating, trenching, and backfilling.
   1. Coordinate piping termination and connection to existing storm drainage system.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPE AND FITTINGS (334600.A01)

A. General: Provide drainage system complete with pipe, bends, reducers, adapters, couplings, caps, collars, and joint materials.

B. Corrugated Polyethylene Pipe: Provide 4" diameter nonperoforated pipe for a complete drainage system, as indicated.
   1. Drainage pipe between 3" to 6" in diameter shall comply with ASTM F 405, “Standard Specification for Corrugated Polyethylene Tubing and Fittings”.
   2. Drainage pipe between 8" to 15" in diameter shall comply with ASTM F 667, “Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings”.
      a. Manufacturers: Advanced Drainage Systems, Inc., Hancor or substitute.

C. Polyvinyl Chloride Pipe: ASTM D 2729.

2.2 SOIL MATERIALS

A. Bedding Materials: Naturally or artificially graded mixture of natural of crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940, with 100 percent passing a 1" sieve and not more than 8 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 INSTALLATION OF DRAINAGE SYSTEM

A. Drainage System: Excavate for drainage system after subgrade material has been compacted. Provide a clear horizontal distance between drain pipe and trench wall on both sides not less than 2 times the diameter of the drain pipe, unless otherwise indicated. Grade bottom of trench excavation to required slope and compact to a firm, solid bed to receive drain system. Apply and compact bedding material to raise low areas or where unsatisfactory bearing soil occurs.
   1. Place supporting layer of bedding material over compacted subgrade where drainage pipe is to be laid to depth indicated or, if not indicated, to a compacted depth of not less than 4".

B. Laying Drain Pipe: Lay drain pipe solidly bedded in bedding material. Provide full bearing for each pipe section throughout its length, to true grades and alignment, and continuous slope in direction of flow. Install pipe and fittings in strict accordance manufacturer's instructions and ASTM D2321 to configurations indicated.
   1. Install piping beginning at low point of system/connection to existing site storm drainage system, true to grades and alignment with unbroken continuity of invert.
   2. Provide collars and couplings as required.
   3. Install pipe pitched in direction of flow.

C. Testing Drain Lines: Test or check line before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.
   1. After testing drain lines, place additional granular material to 4" around sides and over piping.

D. Backfill: Place backfill material in layers not exceeding 6" in loose depth and compact each layer placed.
   1. Carry backfill to indicated finish elevations and slope away from building perimeter.
      a. Allow for placement of 4" of topsoil.

END OF SECTION 334600